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Making Pistons in the Locomobile Shop

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Operations planned to secure a smooth flow of work—Rough turning, grooving and boring done on semi-automatic machines—Compact set of turret-lathe tools

A NEW layout of the piston job in the shops of the Locomobile Co. of America at Bridgeport, Conn., shows some interesting features, particularly in the way that a No. 4 Warner & Swasey machine has been adapted to an operation, or series of operations, that would ordinarily be considered beyond its range; yet it is accomplishing the work very well indeed. The layout was planned to make use of standard machine tools because the relatively limited production does not warrant the use of special tools or very elaborate equipment.

Locomobile pistons are of cast iron. The castings go first to a Gridley automatic where they are rough-turned, step-faced on the end to form the domed head, and the ring grooves are roughed out. The castings are held in this machine by a mechanically operated expanding chuck having two segmental jaws at the outer end (the head end of the piston) and three radial jaws at the skirt end.

The rough-turning tool is carried on the turret, but one position of which is employed, and passes over the back of the work. Following the tool and moving with it is a roller rest, the two rolls of which may be seen at *A* in Fig. 1. This rest passes over the unsupported end of the piston and helps to sustain the upward thrust of the grooving tools, which are carried on the front block of the cross-slide and come into action at about the time the turning tool has finished its cut.

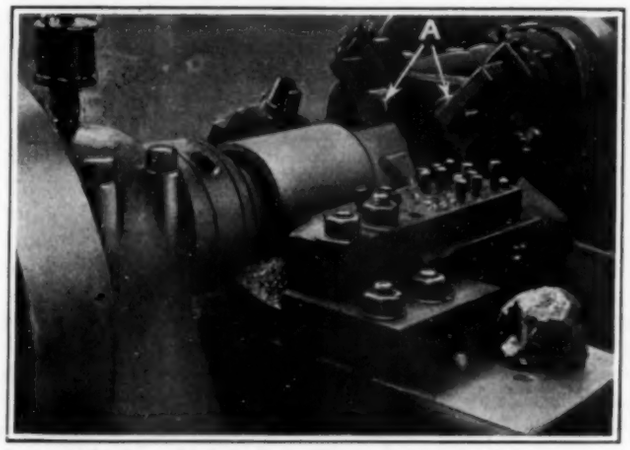

Fig. 1—Rough-turning, grooving and facing

Besides the ring-grooving tools in the front block there is a stepped facing tool that breaks up and removes the scale from the rounded end of the casting and forms the dome-shaped head of the piston in a series of small steps calculated to leave as little material as possible to be removed by the radius facing tool in a later operation. At the opposite end of the block is a short tool that rough-faces the skirt end of the piston.

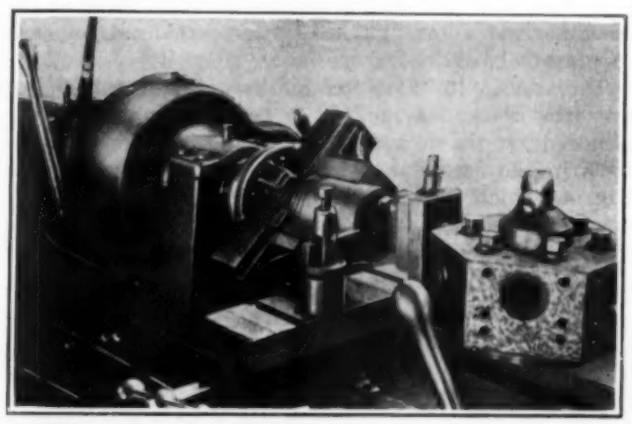

Fig. 2—Boring and facing the skirt

The second operation, shown by Fig. 2, is boring and finish-facing the skirt. The work is held in a two-jawed, manually-operated chuck, fitted with extension jaws that are bored in place to fit the rough-turned piston. The machine is a No. 4 Bardons & Oliver and is operated by the same man that attends the Gridley. As the cycle of each machine is automatic, the operator has little to do beyond unloading and reloading the chucks and applying gages to each piece as it comes off the machine to see that the tools are standing up to

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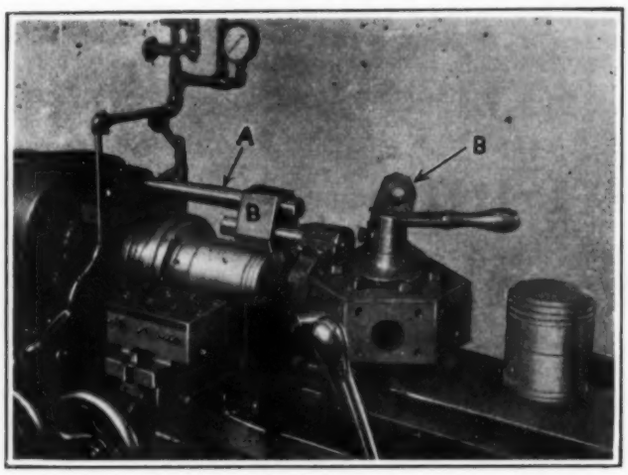

Fig. 3—Finish-turning, grooving and radius facing

their work. The output from each machine is about eight pieces per hour.

Two views of the third operation are shown, one in Fig. 3 with all the tools and the work in place and another in Fig. 4 with the front tool block removed from the machine to show the radius bar and tool that finishes the domed end of the piston. On this machine two cuts are taken over the diameter, two across the end with the radius tool, and two grooving operations are performed.

Three positions of the turret are used; one to spot a center that is essential to the grinding operation by which the pistons are finished to diameter, and the others to carry the turning and chamfering tools. Instead of having a pilot bar on each turning tool, one pilot bar, *A*, is attached permanently to the head of the machine and enters guides *B* that are fixed on each turning-tool bar.

The tool in the first bar makes an intermediate cut over the work, leaving but a few thousandths to be removed by the finishing tool. The positions of the tools in the second bar may be seen to advantage in Fig. 4, which is a close-up of the Warner & Swasey machine with the front tool block removed from the

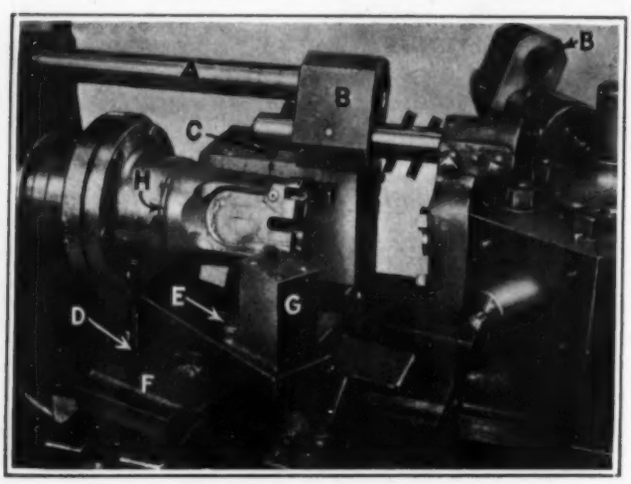

Fig. 4—The radius facing mechanism

cross-slide. The turning tool is at *C*, in advance of the guide, but it does not start its work until after the pilot bar has entered the guide and is ready to support the tool bar against the side thrust. Of the tools behind the guide, the first one reduces the diameter of the piston over the ring portion and the second one chamfers the corner.

The radius bar is pivoted to the bed of the machine at *D* in a vertical plane with the centerline of the spindle. It passes over the cross-slide and is slotted at *E* to receive a shouldered stud, which may be seen at that point. The stud is screwed into the cross-slide and causes the radius bar to swing as the slide advances and recedes. A sheet metal cover, shown at *F*, sets over the radius bar at this point to exclude chips from the slot.

The cutting tool that faces the end of the piston is mounted near the top of the square post *G* of the radius bar and is level with the center of the work. It is so

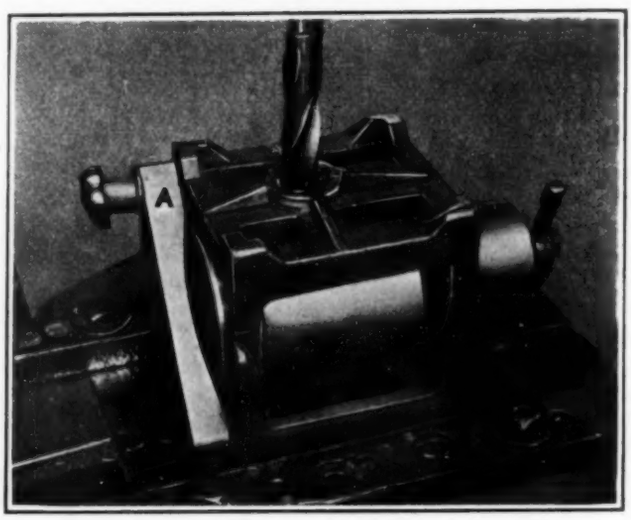

Fig. 5—Drilling piston pin hole

mounted in the post that it may recede from its cut if it meets with undue resistance, and is backed up by a stiff coil spring. A stationary cam, attached to the carriage of the machine and working through a lever inside the hollow post causes the tool to recede anyway when it has reached the center of the work, so that when it passes the center (which it does when the grooving tools in the front block are brought into action) it does not drag on the surface beyond.

The shape of the radius tool is such that it cuts both coming and going. The first passage, from periphery to center, removes the steps left by the serrated facing tool in the first operation and, when the front grooving tools have completed their work and the slide is withdrawn to bring the tools in the rear block into action, there is sufficient spring of the parts to cause the radius tool to take a slight scraping cut over the work in the opposite direction, leaving a very smooth surface.

The pneumatic chuck to be seen in this illustration is a very simple device. The already bored skirt end of the piston fits snugly over the shoulder at *H* while a

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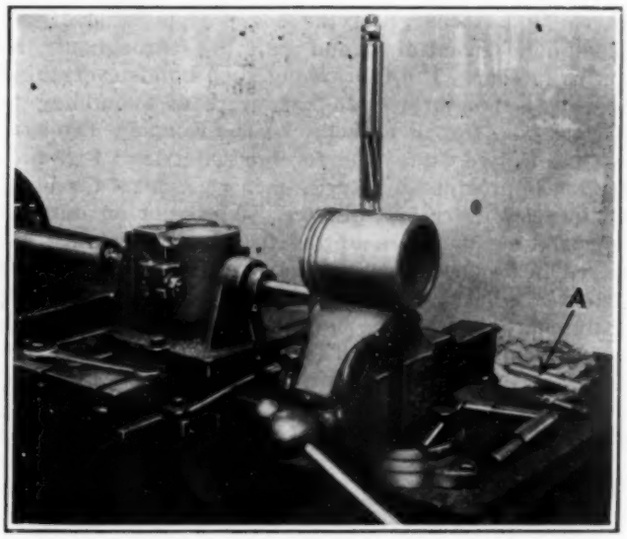

Fig. 6—Boring, hand-reaming and testing

pair of segmental jaws grip the piston from the inside, close to the head end. The jaws swing upon hardened steel fulcrum pins and are actuated by a conical plunger attached to the piston of an air cylinder located at the outer end of the lathe spindle.

The output from this machine is about the same as from the two preceding operations—from seven to eight pieces per hour. The operations have been so calculated as to maintain a smooth and even flow of the work from castings to finished product, and no operator is obliged to wait upon preceding operations or to allow work to pile ahead of him.

The piston pin hole is drilled in the fixture shown in Fig. 5, in which the piston is set over a plug that locates it circumferentially in relation to the bosses. A V-block in which the piston lies sustains the thrust of the drill and the work is held by the swinging bar *A* and its clamping screw. The drilling is merely for the purpose of preliminary removal of stock to make way for the boring bar in the succeeding operation.

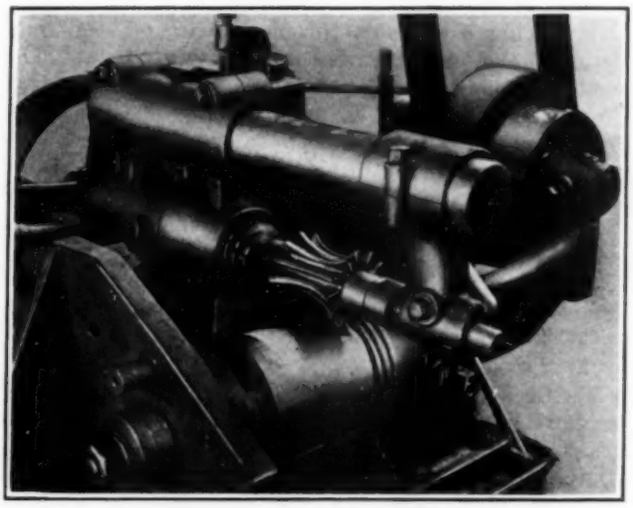

Fig. 7—Relieving side of piston

The boring machine and fixture shown in Fig. 6 finishes the hole. The bar is supported entirely by permanent bushings in the fixture and is independent of the machine. The drive is through a floating coupling that exercises no control over the bar except to turn and feed it.

The operator that runs the boring machine also hand reams each hole as he takes the work from the fixture. For this purpose a line reamer is gripped upright in the jaws of a vise, as may be seen at the right of the illustration, and the piston is turned by hand over the reamer.

Each piston is gaged to see that the bore of the pin hole is square with the axis of the piston. The tool *A* is a hardened steel plug, fitting tightly in the reamed hole and having at the end an arm in which is mounted the barrel and measuring spindle of a micrometer. The operator pushes the plug into the hole as far as may be convenient, turns the arm to a position parallel with the axis of the work, advances the measuring spindle to contact with the wall of the piston and takes the reading. He then swings the arm 180 deg. and takes another reading. It does not matter what the actual readings may be, but it is essential that they coincide within one-half thousandth or the piston is rejected.

The pistons are relieved on both sides over the pin hole. The work is done in a hand milling machine shown in Fig. 7 with the piston mounted on a simple fixture that locates it circumferentially from the bosses and permits it to be turned 180 deg. without removing it from the fixture. This is entirely a hand operation.

There remain but a few minor operations to complete the piston. Several small drain, or "weep," holes are drilled at an angle from the lower ring groove to the inside of the piston, a hole is drilled and tapped into one of the bosses for the pilot screw that retains the pin, the pistons are ground to finish diameter on a Norton cylindrical grinding machine, each piston is individually balanced by boring a small amount of stock from the inside of the skirt, and all the pistons are balanced up in sets of six so that each engine may have a set of pistons all of the same weight.

Allowance for Finishing Pistons, Bull Rings and Cylinder Bushings

There is frequently some discussion as to how much material to leave for finish on cylinder bushings, pistons and similar parts. The Hunt-Spiller Co. advises $\frac{1}{2}$ in. on the outside and $\frac{3}{4}$ in. on the inside for cylinder bushings and 3 in. extra length for holding in the chuck. In other words, the casting for a bushing which is to finish $24\frac{3}{4}$ in. on the outside and 24 in. inside should be $25\frac{1}{4}$ in. outside and $23\frac{3}{4}$ in. inside in the rough.

For pistons it is advisable to have the outside $\frac{3}{8}$ in. larger than the original diameter of the cylinder. Grooves for packing rings should leave $\frac{1}{16}$ in. under the finished packing ring, and the metal under the ring grooves should not be less than $\frac{1}{8}$ in. thick. The same suggestions hold for bull-ring castings.

In plugging the core holes on the side faces of pistons, $1\frac{1}{4}$-in. pipe plugs are recommended.

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Abstracts

from other publications

Nickel-Plating Methods

In this paper by W. H. Graves, chief metallurgist of the Packard Motor Car Co., a practical method of nickel-plating is outlined and the various processes are described by which the Packard company has been successful in producing a durable coating of nickel on automobile parts in general, and the radiator shells, the rim plates and the tire-carrier plates in particular. These are the parts of greatest exposure, and for plating them a new system of moving-cathode tanks was installed. The three problems to which special attention was devoted were rusting, pitting and peeling. No effort was made to secure a coating of any designated depth but reliance was placed solely on the results indicated by a 24-hour salt spray test, which was considered to be the equivalent of 2 years' exposure to the usual weather conditions. Peeling was overcome by thoroughly cleaning the parts before plating.—*S. A. E. Journal*, January, p. 86.

Industry in the South

A paragraph in an article by John A. Piquet states that the automobile industry is also being established in the South. The lack of sufficient machine tool workers is a handicap being remedied by the South's many mechanical colleges, although a policy of immigration from machine centers in western Europe should also be adopted.

Motorwheel and Mengel are some of the body and parts concerns scattered throughout the South to take advantage of unequalled hardwoods now being shipped north to Detroit and Buffalo auto plants. Anderson in South Carolina, Dagmar and Piedmont in Virginia, Corbitt in North Carolina and Kelly Springfield Tire Co. at Cumberland, Md., are some auto or tire units in operation.

With iron, steel, aluminum, ferro-alloys, wood, cheap power, low living costs and a growing automobile market using the South's new highway system all that prevents an immediate development of actual chassis manufacturing is the lack of skilled machinists and the measures advocated above, plus the general growth of metal industries will remedy that.—*Industrial Management*, January, p. 11.

Maintenance Practice at the Ford Plant

The maintenance department of the Highland Park plant of the Ford Motor Co. includes millwright work, plumbing, steamfitting, painting, glazing, trackwork, carpentry, tinsmithing and the fabricating shop; in fact, everything except electrical work and machine repairs. The factory is divided into five territories, each in charge of a competent man who is responsible for all the work in his territory.

Two foremen do not cover the same ground. A floating gang has charge of the heavy piping and of the plumbing, tinsmithing and painting throughout the entire factory. The fabricating shop builds everything from the structural steel framework of a building to a stock-box, for all branches of the company throughout the United States and foreign countries. Fire protection is provided by service men who patrol the plant on bicycles every six minutes. When not on duty as firemen, the members of the fire department are engaged in production work in a room adjoining the fire station. A large number of special devices to assist in maintenance work have been developed, some of which are described in detail. These include hoists for installing lineshafts, trucks, horses, protective netting for the painters, tool-boxes, tool racks, cabinets for pipe fittings and a belt-cutting machine.—*S. A. E. Journal*, January, p. 82.

Production Control

George D. Babcock presented this paper before the joint session of the A. S. M. E. and Taylor Society in December, 1924, stating that the most efficient type of production management is based upon an application of the principles first laid down by Taylor in his paper, "Shop Management," in 1903.

Taylor's work started the thought of putting engineers in charge of the important functions in the supervision of industry and shifted the burden of determining the best methods of doing work from the workmen to those charged with the management of the business. The function of planning includes all of those elements that are beyond the control of the workmen, and some of those that formerly were regarded as within their sphere. It includes a decision as to the material that will be used in the processes of the factory, the exact equipment that shall be used, the method of handling this equipment, the sequence of individual operations on each part of the product, and also the time that shall be taken for each operation. It further includes provision for instructing the workmen in the methods of handling the equipment so as to insure that the performance of the workman will accord with the forecast of the planning department.

In making a schedule for manufacturing, the completion of the final operation is the starting point. The number of days that must be allowed for each standard lot or operation must be ascertained. The length of time that must be allowed between operations for movement of material, for inspection, for seasoning or for any other purpose whatever also must be determined.

It is not enough that the time for an operation by the method in common use be known. For the most efficient management, the time of the best method should be found. For instance, in the machine-shop work there may be several methods available for performing a single operation.

Machines themselves should be standardized so that identical work can be done on machines of the same class. If this is not done there may be a congestion of work at some machines, while others of the same class are idle because they are less efficient.—*Bulletin of the Taylor Society*, December, 1924, p. 260.

Railway and Automotive Springs

By Joseph Kaye Wood
Consulting Engineer, New York City

Effect of leaf shape on bending—Nipping and pulling defined—Importance of leaf-end design—Limitations of manufacturing methods—Balancing theory and practice

IN VOLUME 61, page 719 of the *American Machinist*, the fundamental principles underlying the design of railway and automotive leaf springs were considered in detail by the author. The formulas for load-deflection rate, load capacity and flexibility were derived for one-half of the full elliptic spring having either one full length main leaf or more than one of these leaves. The unavoidable inaccuracy, resulting from the application of these formulas in practice, was shown by superimposing the developed plan view of the ideal or theoretical spring upon the developed plan view of the actual spring.

It is the purpose in this article, to discuss in greater detail the effect of the above discrepancies on the camber of the spring leaves, giving thereby a clear conception of the practice known as nipping and pulling.

In Fig. 1 is shown the deflection of a flat leaf spring of uniform width, while Fig. 2 shows that of a flat leaf spring having a rhomboidal plan view. Both springs have a "positive" camber of equal radii, drawn to an exaggerated degree for the purpose of illustrating the point in question. The qualification that the camber is "positive," indicates that the center of curvature is on the side opposite the applied load instead of on the same side, as in "negative" camber, but will have no particular bearing upon the discussion to follow. It has been chosen simply because it is more commonly employed in practice.

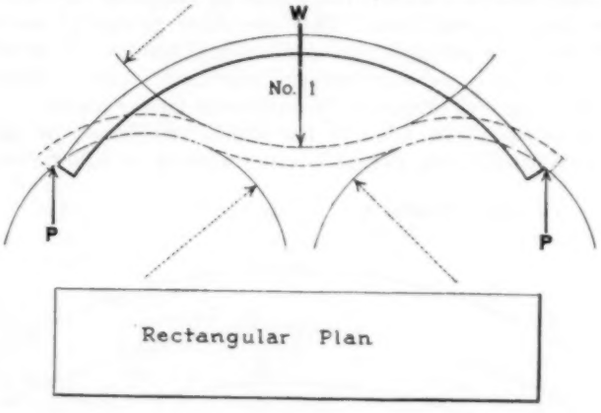


Fig. 1—Loaded rectangular blades showing ununiform bending

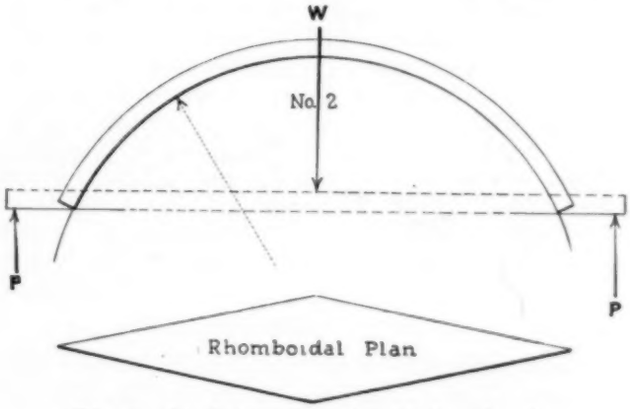


Fig. 2—Loaded rhomboidal blades showing uniform bending

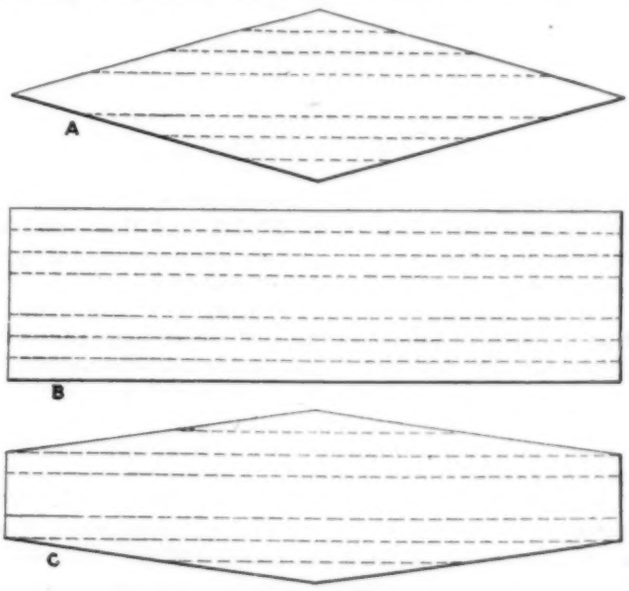


Fig. 3—Fundamental developed plan views

The load *W* deflects the spring in Fig. 1 to the position shown by the broken lines, while the load *W* deflects the spring in Fig. 2 to a position similarly indicated. The reverse bends in the case of spring No. 1 are due to the fact that the cross sectional area, being of a constant width and thickness, does not vary in accordance with the bending moment which ranges from zero at the free ends to a maximum in the center. The result of such a condition is that the material does not bend to a uniform radius throughout its length, but takes a reverse bend or camber where the bending moment approaches a maximum.

On the other hand, as spring No. 2 is being deflected, it assumes an increasingly uniform curvature until, for the load *W*, the radius of curvature becomes infinity, and the spring is flattened to a level surface. The reason for this action is obvious, being that the cross

sectional area varies directly with the moment arm of the applied load. In other words, just enough additional material is offered as resistance to each increment of bending moment to produce a constant curvature throughout the entire length. The non-uniform bending of spring No. 1, as compared with that of spring No. 2, is shown graphically by means of circles which fit certain points in the curvatures of the springs

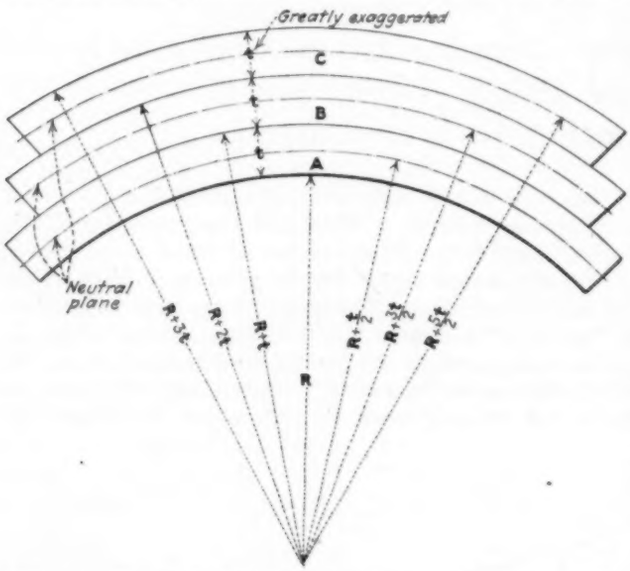


Fig. 4—Theoretical fit between leaves showing no nip

at different loadings. The concentration of stress at the reverse bends, shown in Fig. 1, and the reversal of this stress between tension and compression a great many times, would be a source of weakness.

In the article previously referred to, it was shown that theoretically, a flat spring may be cut longitudinally into a number of strips of equal width and superimposed upon each other to form the very useful leaf spring. It was further shown that the formula which applies to the plate before cutting also applies, theoretically, to the resulting leaf spring. The use of the word "theoretically" here covers a multitude of discrepancies between the characteristics of the spring to which the formula would apply and the actual spring. It is well therefore that the designer should know the cause of these discrepancies in order that he may make proper allowances for them in his calculations.

Developed Plan Views of Leaf Springs

1—In the design of leaf springs, the plan view of all leaves should, in the ideal case, be that of the rhomboidal shape shown in Fig. 3 at *A*. The three principal reasons for this ideal requirement are as follows:

A—To obtain equal distribution of stress.

B—To obtain uniform or circular bending, so as not to have reversed bends in operation.

C—To obtain simplification of design through application of practical formulas which then apply.

2—Although leaf springs having a developed plan view of rectangular shape, shown in Fig. 3 at *B*, can be designed easily by simple and practical formulas, they are objectionable on account of the following reasons:

A—Most uneven distribution of stress.

B—Greatest non-uniformity in bending, thus giving the worst condition of reversed bends during operation.

3—Leaf springs having a developed plan view of the trapezoidal shape, as in Fig. 3 at *C*, may likewise be designed by simple formulas (developed by the author, Vol. 55, page 49, *American Machinist*). This type of spring would also be objectionable for the same reasons given in paragraph 2, but to a much smaller extent. In cases where large capacity, with relatively small deflections, is required, as in railway practice, such designs are satisfactory.

4—Actual leaf springs for various uses, have their developed plan views differing in shape from the ideal shown in Fig. 3 at *A*, to the least tolerable, as shown in Fig. 3 at *C*. Several factors, due to exterior design and manufacture, combine to cause the variations between these two extremes. Such factors will therefore be considered separately, starting with the most important.

Nipping and Pulling

These two factors, which are closely related, do not have any effect on the load-deflection rate of the leaf spring, but they do cause unequal distribution of stress thus tending to produce reversed bending during operation. Since these factors are not controlled in design, due to the lack of sufficient data and proper formulas, they tend to cause uncertainty in the behavior of leaf springs, particularly those in initial production.

Nipping is the practice of giving to each succeeding top plate in a leaf spring a smaller camber or radius of curvature. Before the middle bend is placed around the nipped plates, a crescent of daylight may be seen between them.

Pulling is the practice of closing up the crescent-shaped spaces between the plates by clamping the middle band around them. This operation brings all parts of the plate surfaces into contact and has the effect of introducing a positive stress in the top or smaller plates and a negative stress in the main and larger plates.

Positive stress adds to the stress introduced by the service load while negative stress should be subtracted.

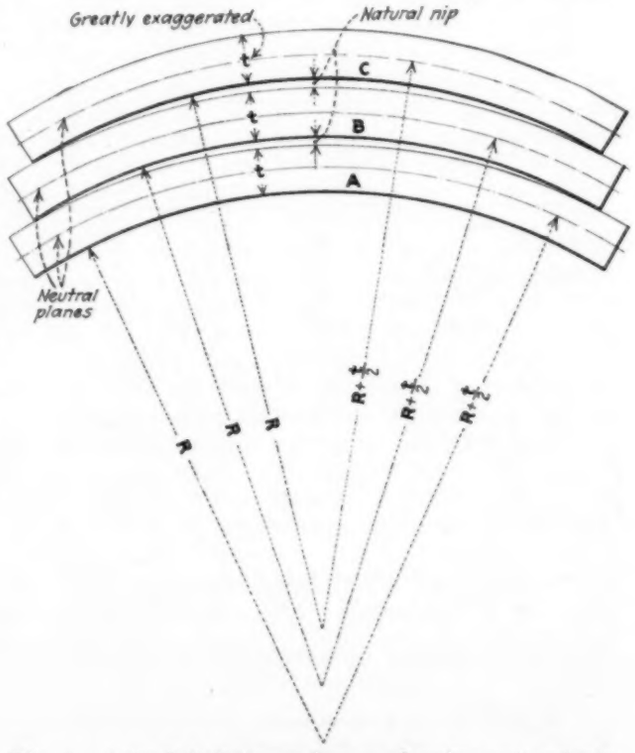


Fig. 5—Actual fit between leaves showing natural nip

The purpose of nipping and pulling as generally given, is rather far fetched and poorly justified on the basis of advantage in design or actual operation. The principal reasons given, and the author's comments, are as follows:

A—To prevent spread or a space between the ends of the plates when the spring is assembled with the middle band. Such a condition would cause overloading of certain plates, i.e., unequal distribution of stress within the whole spring, and would also make a poor

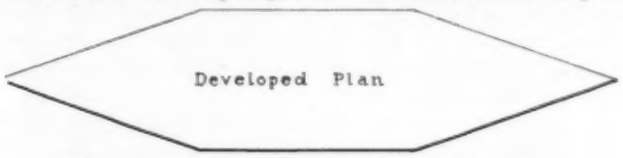


Fig. 6—Result of short plates being too long

mechanical appearance. Mechanical appearance is therefore the only gain.

B—To increase the "liveliness" of the leaf spring.

This notion is erroneous because the period of a spring does not depend upon the amount of stress, but upon the rate of increase in stress with deflection, i.e., the flexibility.

C—To increase the capacity of the spring.

If capacity is taken to mean the maximum load which the spring can safely withstand, then the operation of nipping and pulling will tend to decrease, and not increase the capacity of the spring.

D—To impart rebounding characteristics to the spring.

This is probably true in some cases, but the fact remains that this advantage is obtained at the cost of considerable concentration of stress within some of the plates. The same advantage can better be obtained with the use of clips, for then all plates of the spring are called upon to buffet the rebound. Some automobile concerns design leaf springs with special rebound plates.

In addition to the above reasons, the process of nipping and pulling is quite often justified upon the basis of good old tradition, when most leaf springs were fitted by expert men. The spring plates were nipped and pulled together by hand, in order to produce a "snug" fit between the plates.

Summing the above reasons and comments, in connection with nipping and pulling employed in modern leaf spring manufacture, it may be said that if leaf spring plates could be made on a production basis with the exact theoretical spring camber, then these operations would be unnecessary. However, as we have to tolerate the variations demanded by economical production, it is better to have the disadvantage of poor distribution of stress caused by nipping and pulling, than that caused by spread or poor fit between the plates. In some cases nipping is skillfully employed to control and limit unequal distribution of stress due to other causes.

Natural Nipping and Pulling

In the previous consideration of these operations, the amount of nip was governed by the increase in camber of each succeeding top plate in such a way as to show a crescent shaped space of daylight between the plates. It will now be shown that, due to the finite thickness of the spring plates nip and the corresponding pull are unavoidably introduced.

Plates or leaves of finite thickness, superimposed upon each other, cannot assume a uniform degree of curvature. For example, in Fig. 4, in which the plate thicknesses are exaggerated, the radius of curvature of the upper surface of plate A and the lower surface of plate B is $R + t$. Plate A, however, is bent to a radius of curvature of $R + \frac{t}{2}$, while plate B is bent to a radius of $R + \frac{3t}{2}$. Similarly, plate C which is also entirely in contact with plate B, has a radius of curvature at the neutral plane of $R + \frac{5t}{2}$. But, before the three plates A, B and C were cut from a single rhomboidal plate, the radius of curvature was constant throughout for given loading.

Suppose then, that the single plate is cut into strips or plates which are under load and that these plates are then superimposed upon each other without altering the camber or radius of curvature. The result would be as shown in Fig. 5, in which all plates are bent to a constant radius of curvature of $R + \frac{t}{2}$. The upper surface of plate A has a radius of $R + t$ and the lower surface of plate B, a radius of R, which means that these two surfaces are not entirely in contact, but that only the extreme edges of B's surface are in contact with the upper surface of A.

Between these two extreme edges of line contact there is a space through which light will show. When the leaves of a spring have spaces of this kind between them, they are said to be nipped naturally, since this nip is inherent in the theoretically shaped spring, due

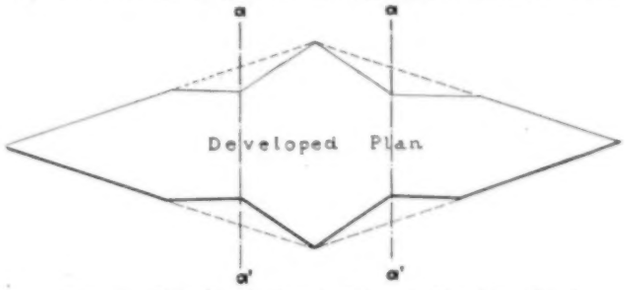


Fig. 7—Result of short plates being too short

to the fact that the leaves have a finite thickness. Natural nip and pull however are very small and produce corresponding small positive and negative stresses within the leaf spring before application of the working load.

Short and Long Short Plates

If the short plates of a leaf spring are beyond the graduated length, making them too long, a developed plan view of the shape shown in Fig. 6 is obtained. A spring of this design is poor, since reversed bending takes place during operation. Although the stress distribution is not uniform in this case, the intensity is nowhere increased above that of maximum bending moment.

On the other hand, if the short plates are too short, or less than the graduated length, a developed plan view of the shape shown in Fig. 7 is obtained. This spring is not so objectionable from the standpoint of reverse bending in service as the spring shown in Fig. 6, but is particularly objectionable due to the weak sections shown at *a-a*.

The effect of finishing the ends of plates with other

than the perfect or theoretical spear shown in Fig. 8 at *A*, is to produce a rather irregular distribution of stress throughout the full length of the spring but not any great concentration of stress at ends or center. The various types of spear ends are shown in Fig. 8, *A* to *H* inclusive.

The ends of the main, or long plate, of a leaf spring should of course be finished with rolled or forged eyes to receive the shackle bolts.

Special consideration should be given to means for holding the plates of automobile leaf springs in their correct relative positions.

One method is to pass a bolt through the center of the spring. Another method, largely employed, is to

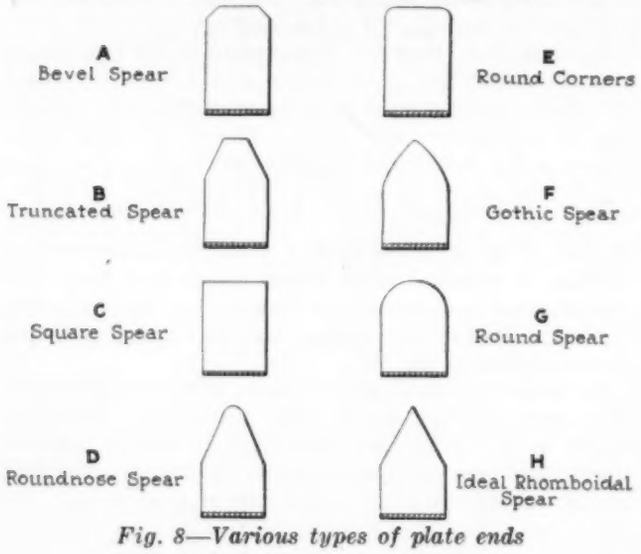


Fig. 8—Various types of plate ends

shrink a band of suitable material on the center of the spring after it is assembled. Further means of holding the plates, is to slightly indent them transversely; the raised portion of each plate made by indenting the opposite side, fitting into the indentation of the plate below. The band itself is indented correspondingly to take care of the lower plate. The band should be as short as possible and still have sufficient strength; center bolts should be small in diameter in order not to weaken the spring too much by drilling through its center. The head of the screw should be of sufficient diameter to afford a good holding surface on the top of the spring. In order to take care of the considerable side-sway, which automobile leaf springs are subjected to, some means of keeping alignment of the plates is necessary. One method is to cut a slot near the end of each plate into which a bead from the plate underneath fits. Another method is to form ribs and slots in such a way that they intermesh between two plates.

Conclusions

1—The ideal developed plan view of a leaf spring for railway and automotive use is that of the rhomboidal outline, for the following reasons:

A—It has a uniform radius of curvature for all loadings and hence does not form reverse bends in service.

B—It has the best distribution of stress throughout its entire length.

C—The characteristics of this type of spring can be accurately determined by means of simple and practical formulas.

2—In actual practice, the developed plan views of leaf springs vary between that of the ideal rhomboidal outline to that of the trapezoidal outline.

3—Leaf springs having the latter type of developed plan view are unsatisfactory, in cases where the working deflection is large, due to the reverse bends which take place and the unequal distribution of stress. They are satisfactory where heavy load capacity with small deflection is required.

4—The process of nipping and pulling, in the fabrication of leaf springs, is for the purpose of providing snug fitting plates and to counteract unequal distribution of stress, opposite in direction to that caused by nipping and pulling itself.

5—In production, if correct relative cambers could be produced in the various plates of a leaf spring, and if unequal distribution of stress, due to such causes as result from long or short short plates, various types of plate ends, and center band conditions, then nipping and pulling would be unnecessary, providing of course, the various plates were fabricated properly.

Developing Machinery versus Selling Hot Dogs

By P. E. Chapman

There are many bright, level-headed, well-educated, intellectual men who can and do develop wonderful machinery, and do not make near as much as many an apparently stupid "nut" selling "hot dogs." Here is part of the reason.

When he starts in such a man will let his desire to get going run over his hope for gain and he estimates jobs high, wide, and open. Yes, he has been cautious to the limit if his figures come out a tenth of the final cost up to the time he actually sees the result.

When he is gray and has had, by good fortune, a long enough margin of time and material jobs to carry the load, so he can show a long list of successful machines to his credit, he will begin to realize that the difference between him and the hot dog man lay in the fact that the latter did not give any of his stock-in-trade away, even if he might have wanted to, until the price and a profit on each red dog came back over the counter to him.

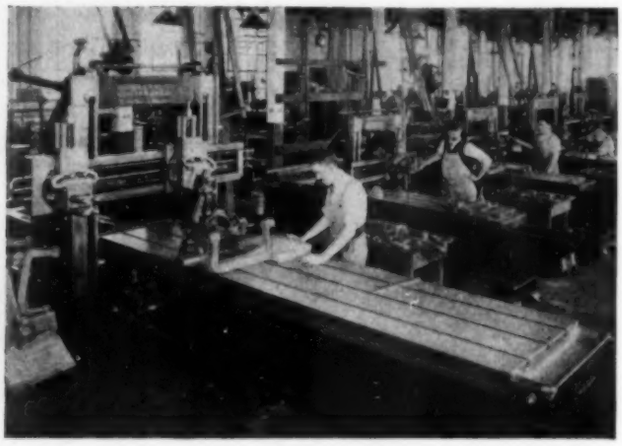
Another thing he will learn perhaps, before it is too late, is that on development work the customer is the biggest liability. His notions, changing his mind, cold feet, credit, impatience, all get going well the day the contract is signed. They are certain to add anywhere from one to a hundred per cent to the price at the end, almost all stood by the builder.

Another machine to the builder's credit is marked on the record but the sad part is that that sort of credit does not buy hot dogs from the hot-dog man.

If you stick the price up at the start, and the prospective customer will not come across, then don't work on their stuff. You will be ahead if you follow this rule.

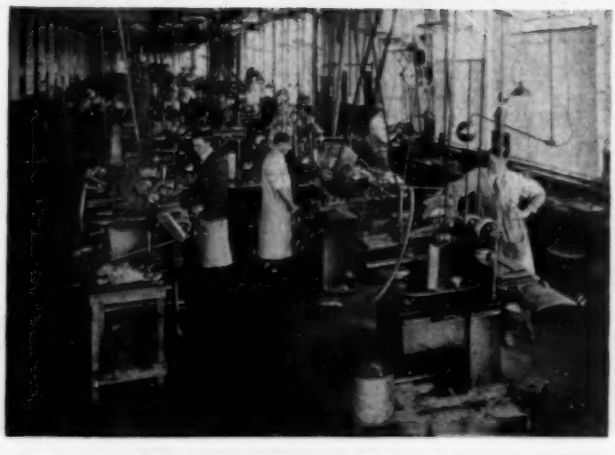
So to the capable inventor, designer and builder of special machines let me say, "Multiply your estimates in making your price by all the things that can happen or sell hot dogs, fix pin wheels, or be a plumber."

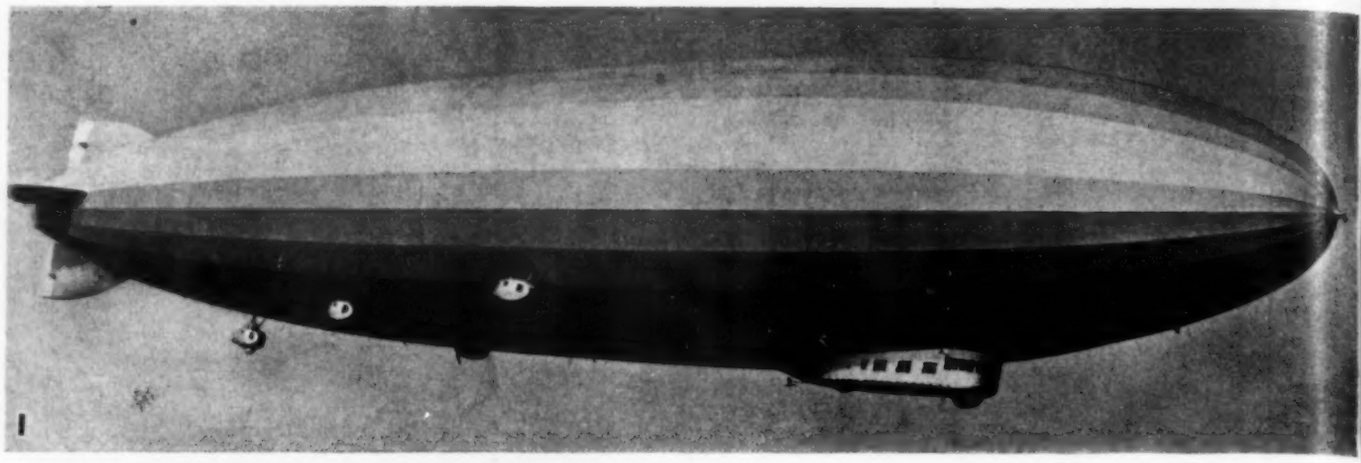
And oh yes, overhead, but that is another long story that helps contribute to the poverty of the special machinery designer and builder.



Modern Machine Tools Build Special Machinery

Photographs by courtesy of Hartford Special Machinery Co.





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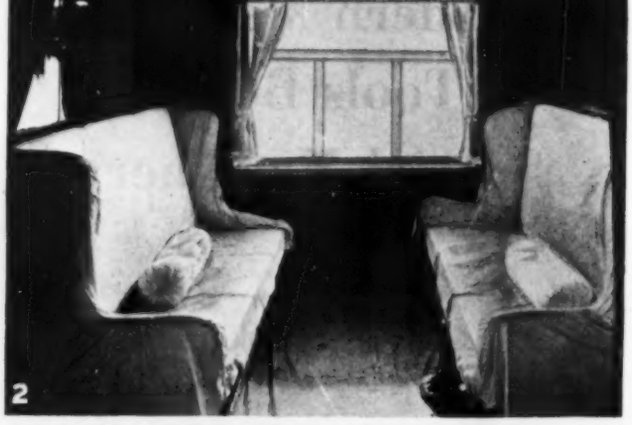


2

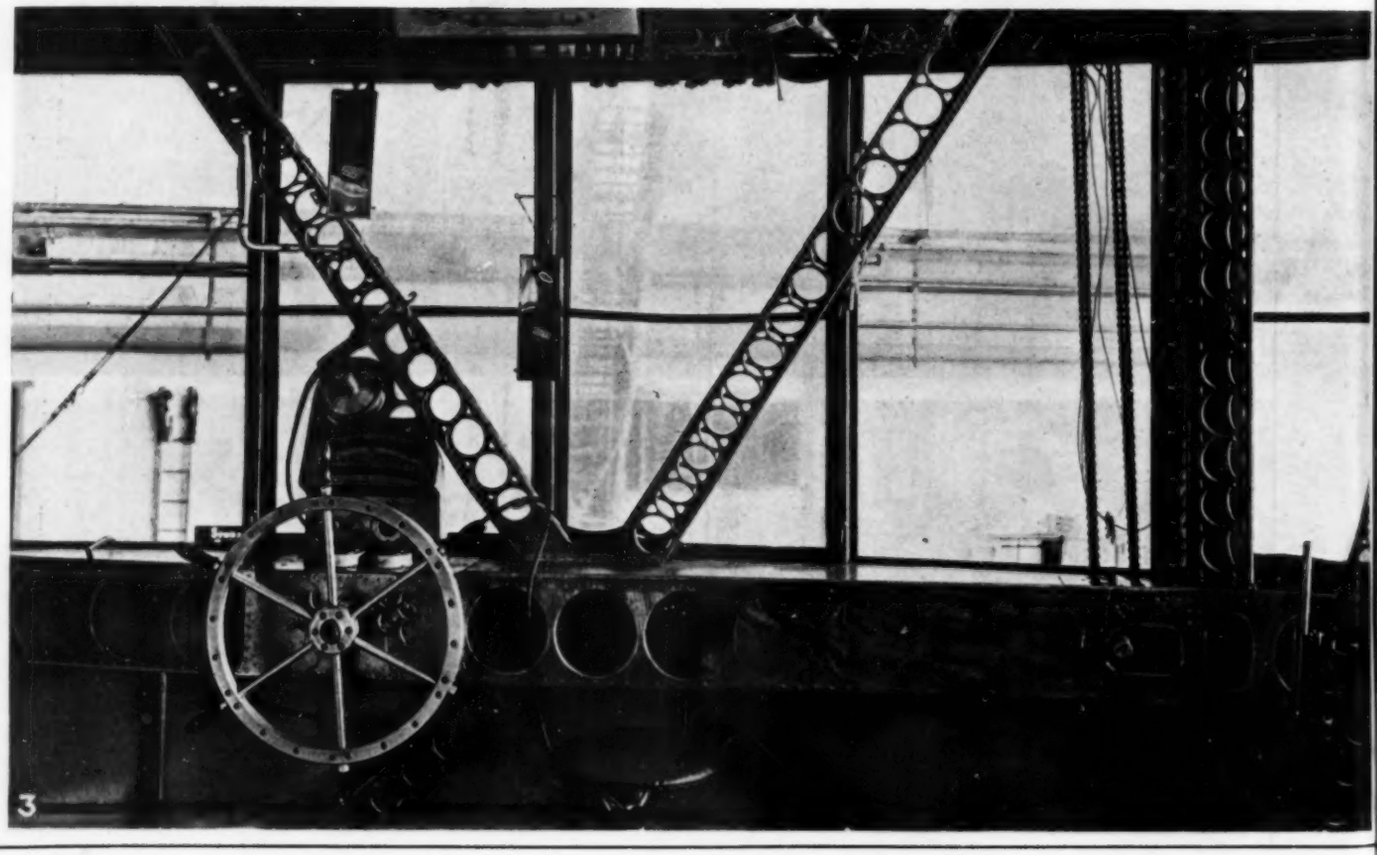
Our Second

Built as the ZR-3

The Los Angeles is shorter than the Shenandoah but larger in diameter and holds more gas. The comparison is:

	SHENANDOAH	LOS ANGELES
Length, ft.	680	660.2
Diameter, ft.	78	90.7
Total height, ft.	96	101.6
Gas capacity, cu. ft.	2,150,000	2,400,000
Weight, lb.	75,000	91,000
Speed, m.p.h.	70	76
Engines, hp.	5-Packard 300	5-Maybach 400

Photographs by courtesy of the International Newsreel Corporation, the Lakehurst Naval Air Station and the Maybach Motor Co.



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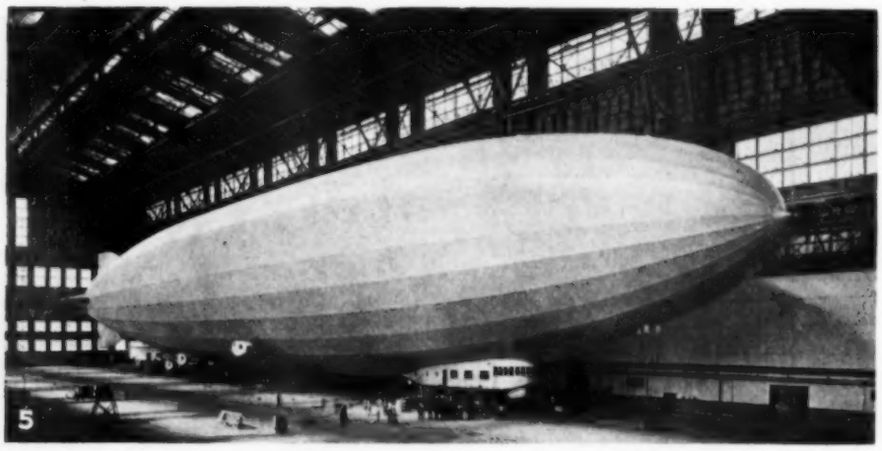


Large Airship

Now the Los Angeles

1—Over the field at Lakehurst, N. J.

2—One of the officers' cabins showing seats and berths

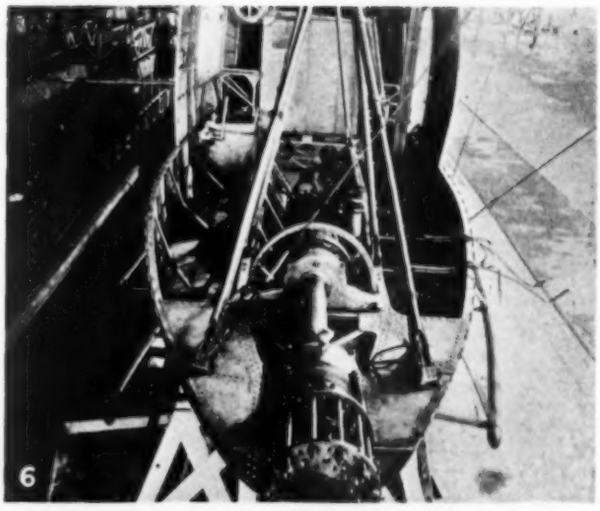
3—In the control car—looking forward. Shows elevating wheel and construction details

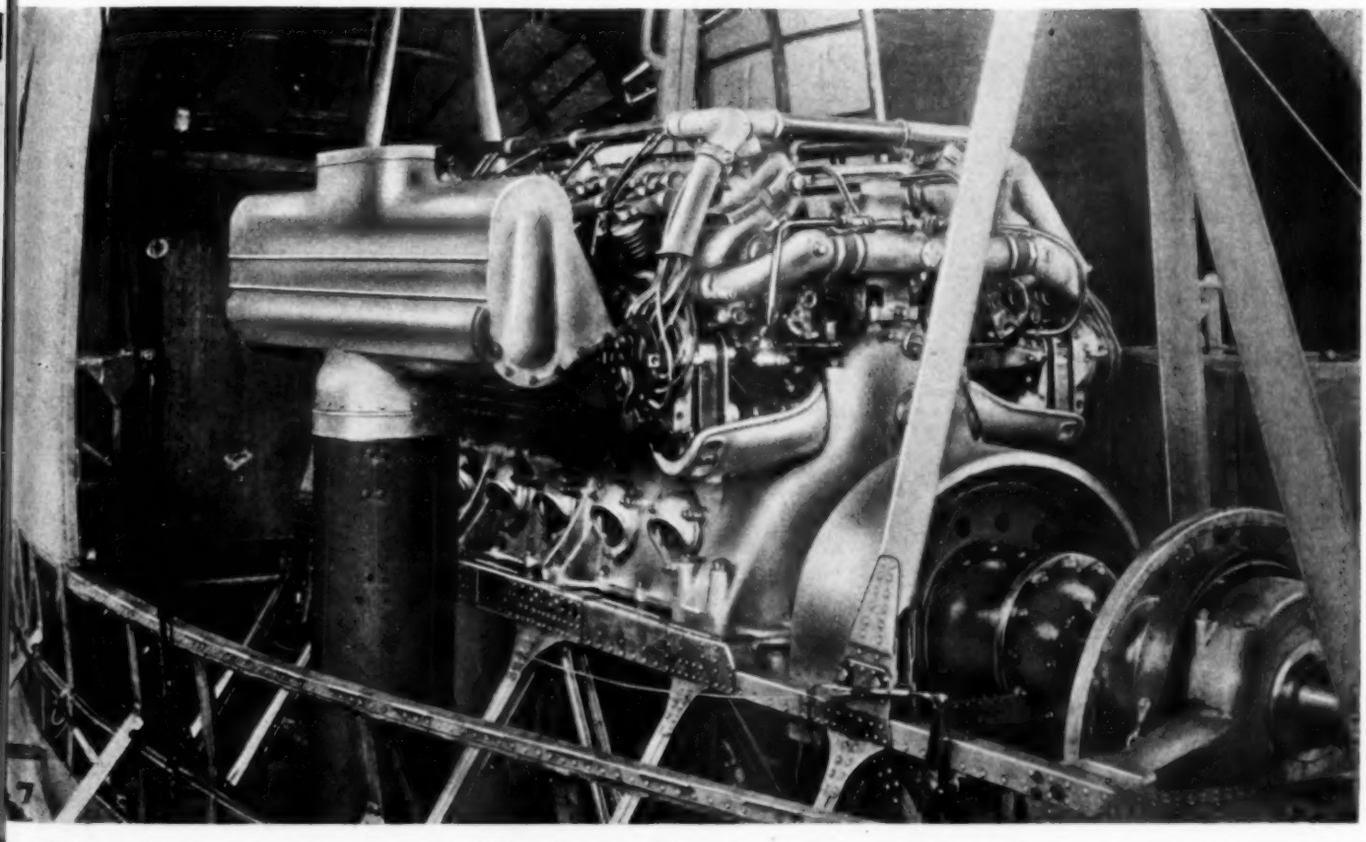
4—Inside the envelope—gas cells partly filled with helium

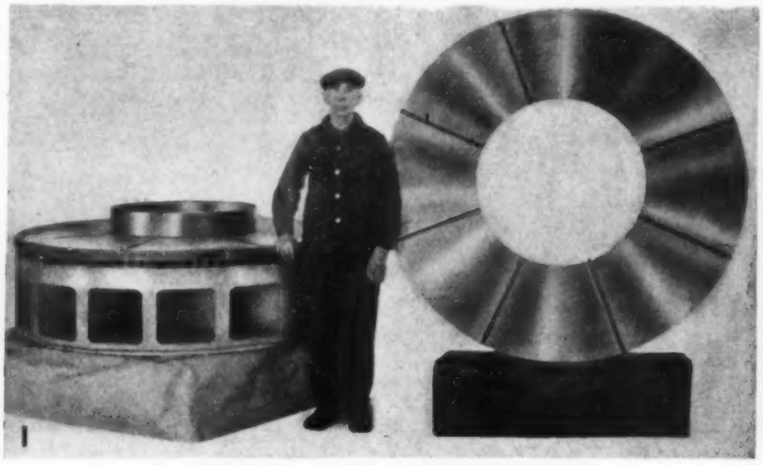
5—At rest in the hangar after the 5,100-mile flight from Frederickshaven, Germany

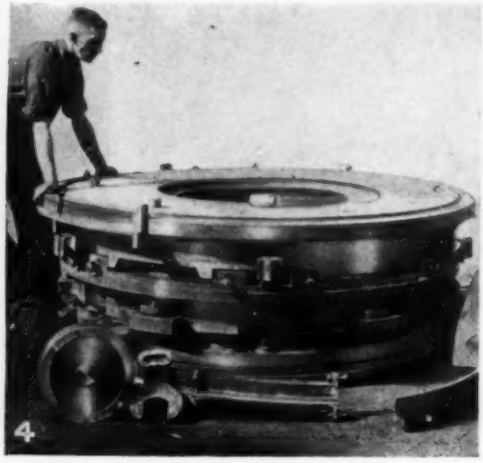
6—Motor foundation in No. 1 power car

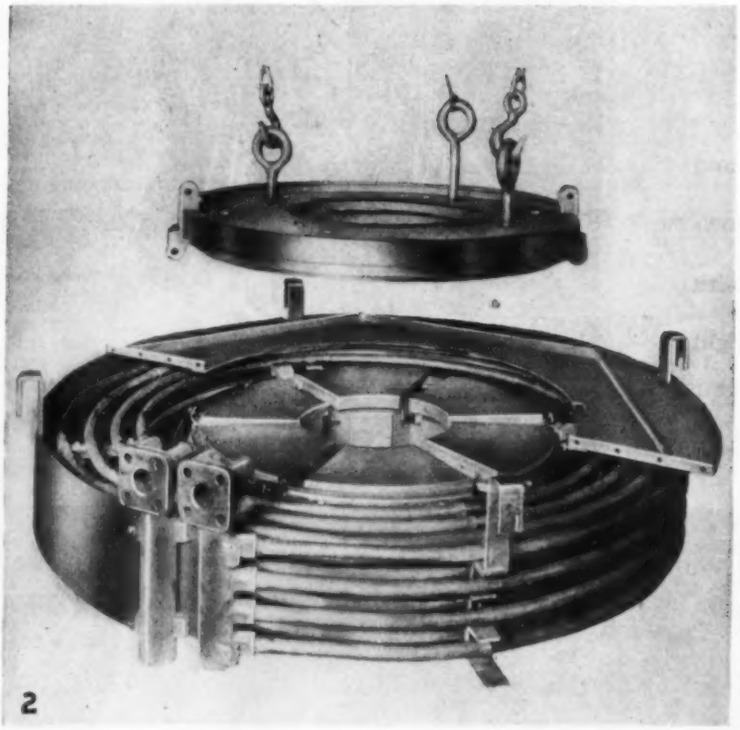
7—One of the Maybach 420-hp. motors in its power car











Heavy-Duty Thrust Bearings

Fig. 1—Spring Bearing. Capacity 1,000,000 lb. Vertical shaft, 54,000-kva. generator at Queenston, Ontario. Built by General Electric Company

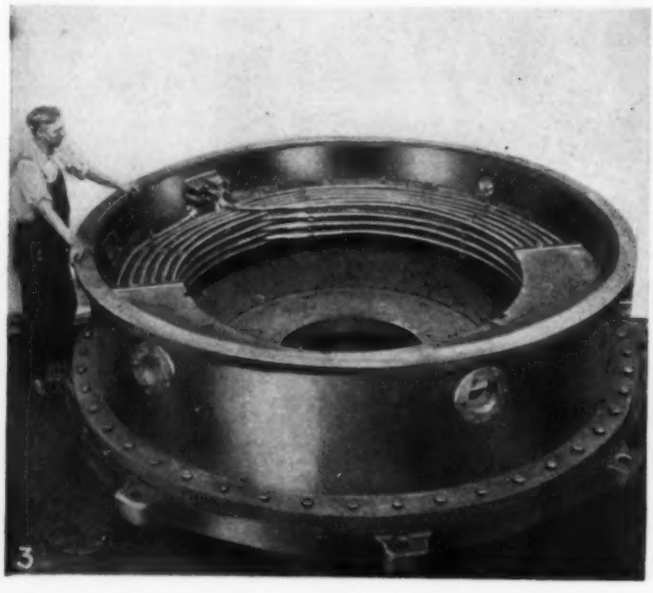
Fig. 2—Water cooled bearing for Queenston generator. Runner above segment has air seal which prevents emulsification of oil

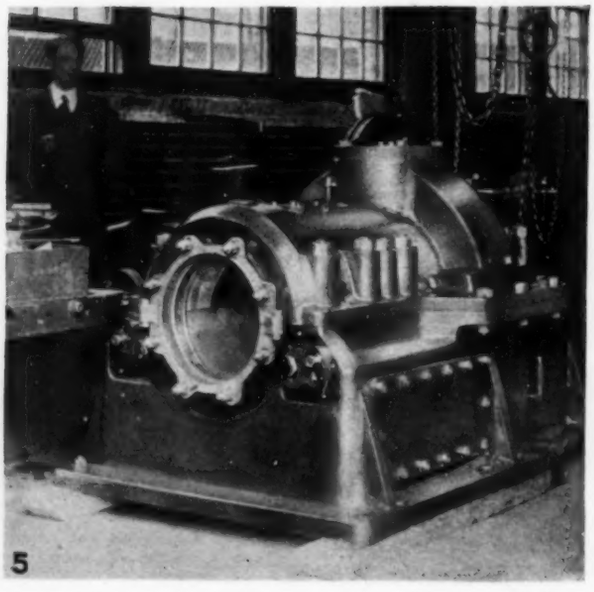
Fig. 3—Cooling coil and housing for one of the Queenston generators

Fig. 4—Assembling one of the sectional bearings

Fig. 5—Air-cooled bearing for Old Dominion liner George Washington

Figures 2 to 5 built by Kingsbury Machine Works, Philadelphia, Pa.





Engineering of Material Handling Machinery Installations

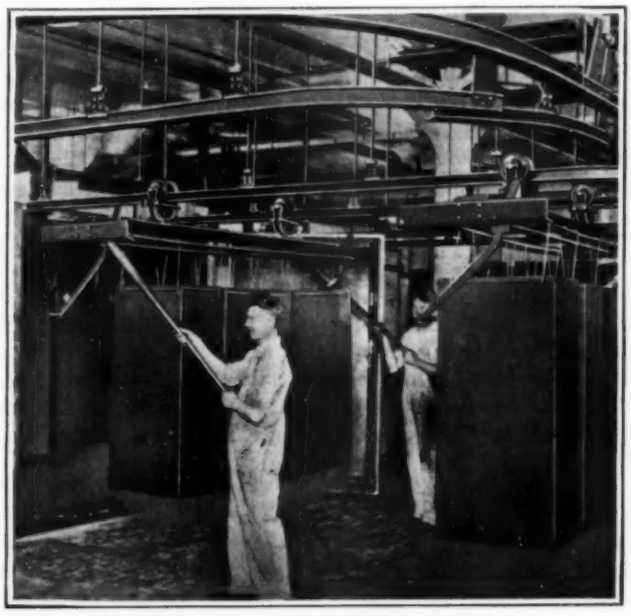
By E. T. Bennington
The Cleveland Crane & Engineering Co.

Sound material handling principles are applicable to all industries —Handling machinery must keep up with production machines— The importance of standardization of product and of containers

THE problem of designing and applying machinery to the handling and moving of materials is one to which no definite set of rules can be applied. Experience, good judgment and common sense have proved effective in attacking a subject of this nature.

All material handling machinery can be separated into two general classes, that which is used as a part of the production machinery of manufacturing plants and that which is used for the sole purpose of handling material on docks, in warehouses, etc. While the same type of machinery is often employed for both types of applications, the engineering problems encountered in applying this machinery are usually entirely different.

The principles involved in the planning of material handling machinery that is to be used as part of the production machinery in industrial plants, is a big subject involving many industries and many angles in each industry and I shall try to explain some of the engineering principles that make a success or failure of the use of material handling machinery in this way.



Handling material in large quantities in the process of manufacture, the material originating from many parts of the factory and delivered to any one of several terminals, requires careful thought and study

The automotive industry, as an industry, is far ahead of any other large industry in manufacturing and production methods. The other industries are continually looking to the automotive industry for ideas when they are confronted with a particularly hard problem.

Just recently I was advised by one of the large pottery manufacturers who had just returned from a visit to the Ford plant at Detroit, that he was attempting to apply to his business some of the production methods he had observed in use there. The production methods which caught his attention were, in the final analysis, purely and simply material handling ideas that would work for him just as well as for Mr. Ford.

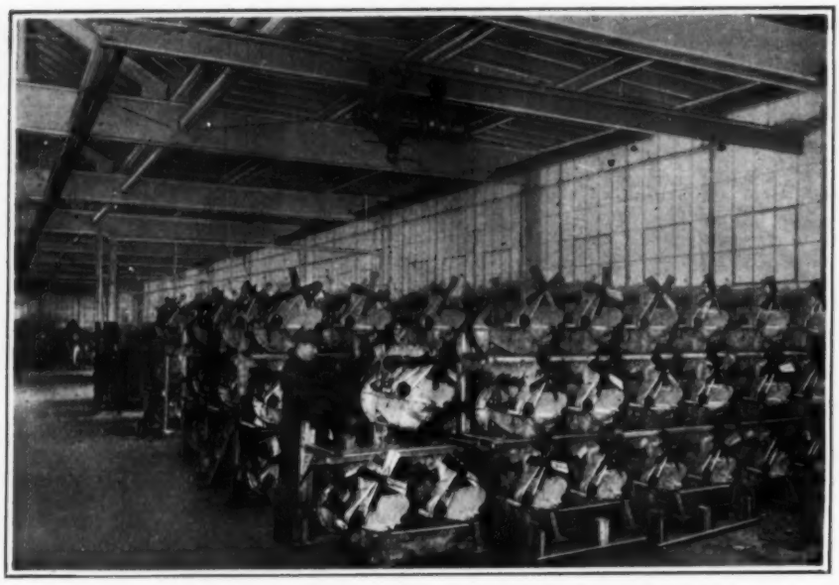
The general manager of a large plant manufacturing box cars in the Pittsburgh district had his engineering department working on a new production system that involved the continuous assembly of box cars while the cars were being propelled slowly through the assembly room, which is exactly what most automobile manufacturers are doing and which is nothing more or less than proper handling of material. It is material handling machinery that makes this kind of assembly possible.

Machine tools and most forms of production tools have reached a stage of development and perfection in which they are about 99 per cent efficient. Automatic punch presses, automatic screw machines and many other forms of automatic machinery are on the market that reduce to an absolute minimum the labor involved in producing the product or performing the machine operation on the product, but the trouble now is how to handle the product to and from the different machines, or in other words, the proper planning of material handling machinery.

I recall recently seeing in Chicago a newly developed automatic turning machine that produced wood handles and wood turnings of different types and sizes. This machine was designed by the particular manufacturer for his own use and he made the machine produce the finished product more rapidly than it was possible to deliver raw material and take away the finished product. In other words, he couldn't begin to keep the machine in continuous production because he had not incorporated a system of mechanically handling the material to and from the machine, and such a system was a necessity.

Presented before the Cleveland Section of the American Society of Mechanical Engineers, Dec. 15, 1924.

[The author's remarks on installation for docks and warehouses have been omitted as being foreign to the field of the *American Machinist*.—Ed.]



A material handling engineer is oftentimes called upon to devise ways and means of increasing the storage capacity of the given space. Here is the way in which this problem was solved in a large automobile factory

A plant that is properly equipped with the latest production tools and that still depends on hand labor to remove the material to and from the production tools is not properly balanced. It is not an easy matter to plan an installation of material handling machinery in a manufacturing plant that was not designed to accommodate it or in which the location of the machines is such as to make the use of any kind of material handling machinery a difficult problem to solve. This sometimes makes it necessary for the engineer in charge to accept a compromise between what would be ideal and what would be most practical for his particular conditions, but in starting to plan the material handling machinery he should start at the foundation and one of the first difficulties that will usually manifest itself is the lack of standardization of the product of the plant in which the machinery is to be used. This lack of standardization need not in itself render the use of material handling machinery impossible, but it does bring home to the engineer the necessity of applying ingenuity to the problem in an effort to take the product as it is and develop standards that will permit machinery to be used.

Lack of Standardization Costly

Two years ago there were many automobile manufacturers who would sell you a car and let you select the color of paint and other details of finish as well. Today there are very few companies that will do this, and none of the large companies that are using real production machinery will permit you to have anything but a standard machine. Gray paint does not cost any more than black paint, but the lack of standardization in output costs a great deal more than most engineers realize. It is true that every company cannot confine itself to a standard product but there are many companies that could.

Before the war one pottery manufacturer produced several thousand styles and designs of bathroom pottery. His policy at that time was to make a special design for each jobber but today he has adopted continuous production of a standardized line of less than 100 designs, and these designs are all worked out with the idea of permitting the use of the same material handling machinery in each case.

When I recommend standardization, I do not mean to produce only one part or piece, but I mean to produce as many styles and kinds as standardization will permit.

To illustrate this point, there is a large bolt and nut factory in the East that has always operated an up-to-date plant in so far as the machine tools are concerned but only recently installed machinery to take the material to and from these machines. At one time this company was making anything that a customer asked for in any quantity. The customer even specified the kind of steel to be used, the style of thread, etc., on very small orders. Every order the shop received was run through as a separate item and had to be kept separate throughout the plant from the rest of the orders. Sometimes these orders would consist of only 10 or 15 special bolts and there were hundreds of individual orders in the process of manufacture at all times. This made the use of material handling machinery impracticable and it also made the cost of production extremely high. The manufacturer finally selected certain sizes and kinds and had a printed stock list given his customers at regular intervals. This gave the customers something to go by when ordering and the result was that a customer who would have ordinarily ordered a bolt with a square head for a certain job would take a bolt with a hexagon head because he knew that the bolt was standard and he could get good delivery, the manufacturer thereby putting himself in a position where he could figure ahead on what his orders would call for and could run his product through his shop in larger lots thus making the use of machinery very practical.

The Containers Standardized

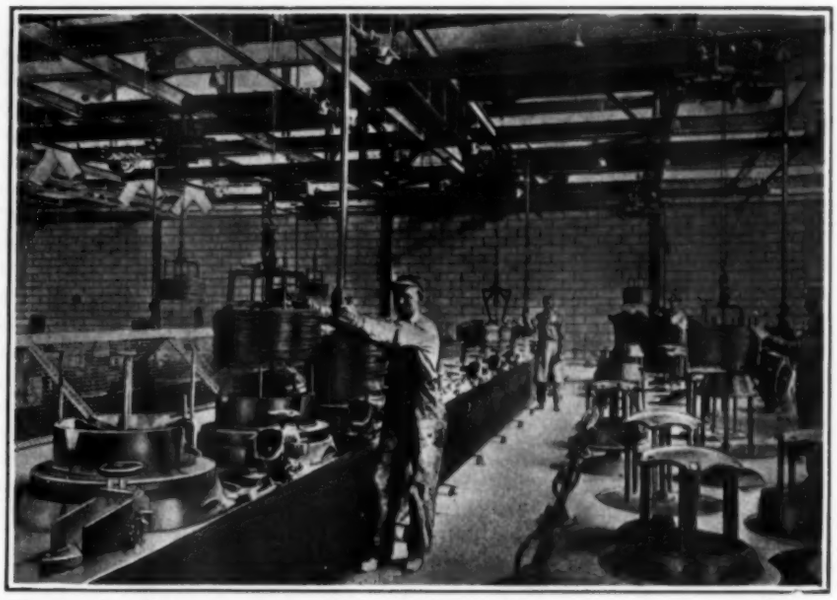
The next step was the standardization of the container in which the material was handled through the shop. This was the important step from the material handling machinery point of view. It used to be the custom in this shop to have containers of all sizes in use, the size of the container usually depending on the size of the customer's order, but now that continuous production is in effect only one size of container is employed.

This is the size that best suits the material handling machinery and it consists of a bucket which handled about 1,200 pounds of bolts at one time. Therefore, with only one size of container to handle the product from one machine to another and from one department to another, it was possible to use one kind of material handling machinery. The machinery was so installed that the individual pieces that must be handled by hand in feeding the machines were always at the operator's elbow, and an empty container was at his other side in which the finished pieces were placed. When the container was filled, it was pushed to the machine that performed the next operation.

The increase in production and the decrease of labor was beyond the fondest expectations of the manufac-

turer at the time he went into this scheme. He increased production because he was able to keep his machines constantly turning out product. The operators had raw material at hand at all times. It was not necessary to permit the machines to run idle every few minutes while the operator procured another 50-lb. tote box of raw material or disposed of finished material as had been true under the old scheme of things. The handling labor was reduced because 1,200 lb. of material could be handled by machinery in about the same time that it took to handle 50-lb. tote boxes by hand.

What standardization of product and standardization of handling methods did for this bolt and nut manufacturer, it will do for other manufacturers in other lines.



Illustrating the manner in which 300-lb. bundles of wire are handled by easily propelled, push-button controlled, hand power cranes. Bundles of this size would be impractical without the use of material handling machinery

With every engineer who is planning a material handling machinery installation one of the first questions that must be answered is regarding the size and number of containers or units of production that are to be handled, or that the nature of material will permit being handled. This must be determined before the type of material handling machinery to be used can be decided upon. There is no standard rule that can be applied to this problem. Even in the same institution, the conditions of each plant are usually the determining factor.

I want to point out a few things I have observed recently that may give some light on this subject. About three years ago one of the large steel companies decided to build a new wire mill that would be the last word in wire mill construction. One of the first questions that had to be settled in designing the buildings was the size of the bundles of wire that would be produced, or in other words, the size of the unit of production. In the early days of the wire mill industry most mills produced a 50- to 75-lb. bundle. As years went by the size of the bundle kept increasing as new and larger equipment was added until some of the mills were producing 200-lb. bundles. The engineer in charge of the design of the new mill finally decided to install equipment to produce wire in 300-lb. bundles and to install material handling machinery to handle these bundles. Some of the old hands at the business predicted failure at the start but it has been proved conclusively that 300-lb. bundles are possible, providing material handling machinery is used.

There is, of course, a practical limit to the size of the unit. I have rarely seen instances in which the units of production have been increased beyond the size that one man can handle with the material handling machinery provided, and I am of the opinion that it is this factor, more than anything else, that should limit the size of the units of production. Therefore, if the size of the units of production is to be increased it places the burden on the shoulders of the material handling machinery manufacturers to so design and build their machinery that the hand-propelled machinery will move easily. It must not be too heavy or cumbersome in itself, it must be flexible enough to be readily adapted to the usual type of manufacturing plant without necessitating the alteration of the plant or the relocation of machinery or other expensive changes.

The electrical machinery or power driven machinery should have incorporated in its design all of the refinements of detail and refinements of control that modern science and engineering have made possible, and last, but by no means the least important, the material handling machinery that is to be used as part of the production machinery must be substantial. The progress that has been made in the designing and refining of material handling machinery in the past few years must be surprising to one interested in the subject, and yet not actively engaged in the business.

Some manufacturers are employing the use of steel of unusual tensile strength in an effort to give strength and lasting qualities and at the same time reduce the weight to a minimum. This is a plan which all manufacturers of machinery of this nature must adopt sooner or later. Ordinarily cast iron or semi-steel have no longer a real place on a machine that must be moved about a plant by power or hand, as the same strength can be obtained from material of about one-quarter the weight, which increases the flexibility and the life of the machinery.

Europeans Taking More Interest in Automobiles

A general survey of nine European countries during the past summer, including attendance at three automotive exhibitions, has left many enlivening impressions states *Commerce Reports* published by the Department of Foreign and Domestic Commerce. In every case, the conviction has grown that interest in modern motor transportation is developing in Europe in a measure comparable to that in America, and that this is stimulating a supply of products from native sources which must be reckoned with by American manufacturers and exporters. The number of visitors at all three exhibitions was of record-breaking proportions, conclusively demonstrating public interest.

Book Reviews

Eyesight Conservation. Paper covers, 95 pages, 6x9 in., illustrated. Published by the Eye Sight Conservation Council of America, Times Bldg., New York, N. Y. Price 40c.

"Eyesight Conservation" describes lantern slides and lecture material covering many phases of the subject of eyes and their use and abuse in all walks of life. It is intended, primarily, to guide and instruct those who have opportunity to control the thoughts and actions of others in the earnest effort to dispel the shadow of ignorance and give that basis of comparison by which we may judge.

The book can be obtained by applying to the Eyesight Conservation Council. The lantern slides and lectures are listed and, upon selecting those which are desired, it is necessary only to notify the council in order to receive them at a minimum cost.

The makeup of the book is admirably suited for its purpose and if, in addition, means may be found to get the book itself into the homes and the institutions and schools it will perform a wonderful service.

No possible step can be taken in the direction of eye conservation that will not return manyfold to our benefit.

Arc Welding and Cutting Manual. Cloth boards, 127 pages 8x10½ in., illustrated. Published by the General Electric Co., Schenectady, N. Y., designated as Y-2007.

While the science of welding and cutting is still in comparative infancy there are probably as many men engaged in the art who hold they are experts, as there are claimants to descendency from the party that landed at Plymouth Rock some years ago.

It is true that every day sees more men actually mastering the problems, but there will be a large percentage among them who will continue to hold back development, just so long as those who are given charge of welding departments continue ignorant of the fundamentals of the art.

Even a casual glance through the pages of the Arc Welding and Cutting Manual is sufficient to show that the General Electric Co. has published a book that will go a very long way toward assisting the operator who wants to learn, and guiding the foreman and the inspector with whom rests responsibility for production and quality.

The purpose of the book is defined on the frontispiece as follows:

"To acquaint the uninformed in a general way with some of the applications of arc welding and to provide a simple and logical method by which one may acquire a certain familiarity with the manipulation of the electric welding arc and its characteristics."

This statement is modest indeed. While no man can hope to master any art through the study of one text, the information that is set forth simply and understandingly in this manual will enable any average man to judge his own or another's ability to perform satisfactory work, the lack of which accounts for the immunity of many self-styled experts, and the performance of faulty work, to the hindrance of progress in the art and the loss to industry as a whole.

The manual is divided into three main divisions, a general treatise, a training course, and practical illustrated applications.

Paragraphs on penetration, arc length, and arc stability, in part I, promptly clear up many a present-day dispute based on ungrounded personal opinion. Striking the arc, making the weld, and being able to read what to expect, by observing characteristics of the metal seam deposited, various methods of depositing metal under varying conditions, patching, filling, butt welding, lap welding, flat, upright, and overhead, are so happily described in part II, that any man of average intelligence can follow directions, and any other, similarly equipped, can judge the quality of his work.

More than enough applications are shown, illustrated and clearly described in part III to cover present-day attainments thoroughly.

Tables and diagrams supplement and broaden the descriptive matter throughout the manual.

The authors proposed to acquaint the uninformed in a general way with some of the problems of arc welding. If every man who handled a welding outfit today knew a fair portion of the truths put down in this manual, the general status of arc welding and cutting would be greatly improved. The book should prove to be a popular one.

Technical Mechanics. By Edward R. Maurer, Professor of Mechanics, and Raymond J. Roark, Assistant Professor of Mechanics, University of Wisconsin. Clothboard covers, 363 pages, 6x9 in. Published by John Wiley & Sons Co., Inc., New York, N. Y. Price $3.50.

While the continued success of an accepted text book such as Technical Mechanics, now in its fifth edition, depends more on the number of students taking the course in which it is prescribed than on their own collective choice of a given text, the success of the students themselves is very largely determined by the manner of its make-up and presentation.

The tendency of many technical authorities, in compiling such a work, is toward the capacity of the above-average student who can grasp meanings implied, rather than toward the short-comings of his less fortunate brother.

The authors of Technical Mechanics have evidently appreciated the value of step-by-step explanation of the points they make. There is an added incentive to average student interest in the thoughtful choice of illustrative examples.

There are three main divisions dealing with statics, kinematics, and kinetics, each divided into a number of chapters chosen with evident thought to their value in actual practice.

Two appendixes follow these main subjects and deal with the theory of dimensions of a unit, in the first, and moment of inertia and radius of gyration, in the second.

There is, finally, a representative list of problems which are grouped in line with their application to the test.

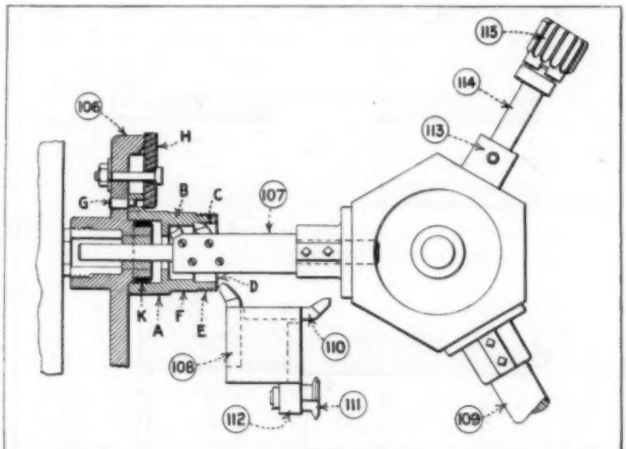
The form in which the book is assembled, keeping the necessity of reference to other tests to a minimum, makes it a valuable addition to the library of the busy engineer who needs to refresh his memory from time to time but who cannot devote much time to locating the proof of his calculations.

How to Estimate Machine Shop Costs

By Albert A. Dowd

Time estimates for turret lathe tools and fixtures—Estimating costs of making cutting tools—Jig bushings and hook-bolts—Valuable records and forms for estimating

AN IMPORTANT phase in estimating tool costs is that portion which applies to turret lathe tools and fixtures. A difficulty which the estimator encounters on this class of work is the fact that he frequently is obliged to make his estimate from a small scale tool lay-out or even one which is not to scale at all but made free hand. In a sense this is "guess work" estimating and yet experience on tools and fixtures for turret lathes makes it possible to do very close work. It is a great help to have a tool lay-out made to scale even though all details of tools are not shown. Approximate sizes can be easily obtained by scale measurement and a very good general idea of the tool construction can be formed in the mind of the estimator so that he is not likely to omit important details.



OP. NO.	DISCRIPTION OF OPERATION	MACH.	TOOLS REQ'D.	TOOL NO.	REMARKS
1	Locate on plug in face plate	#627	Spec. face plate	106	
	Rough bore B and C, rough		Piloted boring bar	107	
	face D, rough turn E and F		Forged tool	108	
			Std holder	Stock	
2	Finish same surfaces		Piloted boring bar	109	
	as in operation #1		Forged tool	110	
			Std holder	Stock	
3	Chase thread at E-using		Circular chasing tool	111	
	chasing attachment		Spec. tool holder	112	
4	Ream hole B		Floating holder	113	
			Reamer bar	114	
			H.S. Reamer 4.490	115	

Fig. 64—Layout sheet for turret lathe tool estimate

A lay-out sheet for a piece of work *A* which is to be machined on a turret lathe is shown in Fig. 64. All the tools and fixtures specified are to be furnished to the customer. It may be for use in connection with a new machine sold to the customer or it may be equipment designed to be used on an old machine. If the estimate is made by the concern that manufactures turret lathes for the market, the shop equipment will undoubtedly be more suited to the work than if it were to be done by a regular tool shop. We shall consider that work is to be done without gages as would be the case in a regular tool shop.

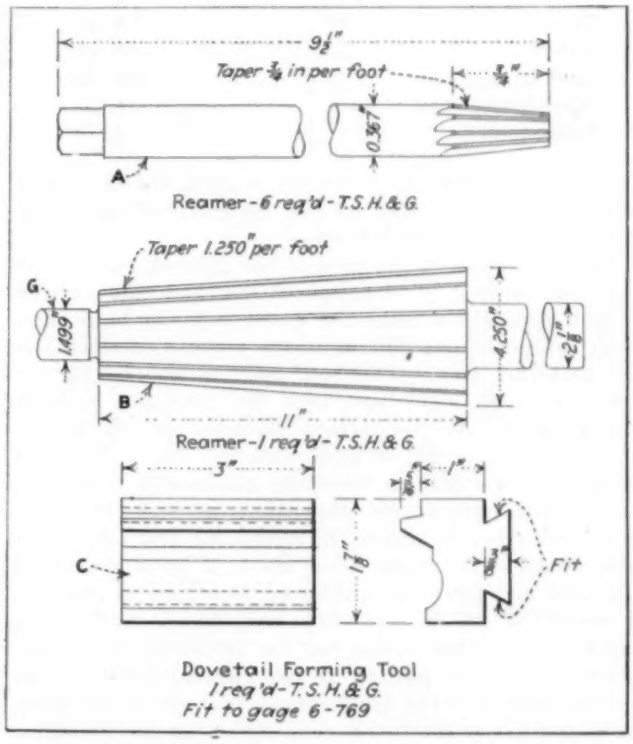


Fig. 65—Examples of cutting tools for estimate

The first step would be an estimate on the holding fixture numbered *106*. He would consider first the pattern which is of a simple nature although 18 in. in diameter. The pattern maker's estimate on it would probably be about 6 hr. as there is no core work required and only three projecting lugs. Assuming that the thickness of metal is 1 in. and the diameter 18 in., it would contain 254.47 cu.in. If we add to this about 100 cu.in. for the hub and lugs we can figure the weight of the casting as $354.0 \times 0.26 = 92$ lb., or in round numbers, 100 lb. The face plate is to be bored and threaded to fit the spindle of the machine and, as

This is the nineteenth article in the series. The eighteenth was concluded on page 62.

we have assumed that there is no gage for this part, the obvious way to obtain proper accuracy would be to make first a master plug to the exact size of the spindle or to obtain a plug from the customer. Allowance should be made for this item depending on conditions. In machining the face plate fixture it would first be bored and threaded to the plug mentioned, after which it would be set up again preferably on the plug as an arbor and the other side machined so that it would be concentric. The locating plug *G* would be put in according to the dimensions called for on the work and the three holes drilled for the clamp studs. The hardened and ground locating ring *K* would be fitted and forced on to the boss on the fixture. The clamps *H* would be made and fitted and the pilot bushing *X* forced into place. The estimator would consider all these items and would probably allow from 30-40 hr. for the work, including assembly. He would add enough machine steel and tool steel to make the clamps and bushings and would lump the whole amount as so many labor hours and so much material. The summary would be:

Patterns	6 hr.
Labor	40 hr.
Cast Iron	100 lb.
Machinery Steel	18 lb.
Tool Steel	4 lb.

To make sure that no items are missed, the estimator would probably number all the tools according to the numbers given on the lay-out.

The next item to consider is the piloted boring bar *107*, and as this is identical in size and construction with *109* he would make the figure to cover both bars. Next comes the question as to the amount of stock and the material used. The best practice would call for low grade tool steel bars with the pilot and locating end ground. As the largest diameter of the bar is 3½ in. with a length of approximately 24 in. it would be more economical to have the blacksmith forge two bars to the approximate dimensions as there would be much less stock to remove in machining and very much less waste. We might allow about 2 hr. for forging the bars and figure according to their cubical contents a weight of 30 lb. for each bar, 60 lb. total. The machining problem would call for centering both ends, finishing all over, putting in two angular holes for the boring tools, drilling and tapping four set screw holes, milling a flat at the turret end, hardening and grinding, making, fitting, hardening and grinding cutters and assembling. The time required for rough turning ready for grinding and for the various operations mentioned would probably not be figured by the estimator as he would guess at the time about as follows: Rough turning all over, each bar—4 hr.; drilling cutter holes and drilling and tapping set-screw holes for each bar—about 2 hr.; milling flats—1 hr.; making and fitting two cutters from round stock, bright drawn—2 hr. more; hardening and grinding bar and cutters—4 hr.; fitting and assembling—3 hr. We are of course assuming that workmen on this class of work are familiar with the requirements so that they do not spend an excessive amount of time in setting up. The estimator would probably allow from 18-20 hr. for each bar.

As we take the tools in sequence we can consider the two forged tools *108* and *110* to require the same amount of labor and it is customary for plain forged tools of this kind to allow from 1 to 2 hr. time for forging, shaping and grinding except when special forms are required. As tools are high speed steel, the weight of the material would be figured carefully and included at the current price per pound. The writer has known cases where forged tools like this weighing about 3 lb. apiece were charged to the customer at $16 each but with high speed steel at normal prices about $8 or $10 as a maximum should be sufficient.

The thread at the end of the work *E* is cut with a special form of chasing tool *111* held in a holder *112*. The chasing tool is of circular form and we should probably allow about 6 hr. for making it. For the holder and special bolt which holds the chasing tool in place about 6 hr. more should be sufficient. The steel cost is estimated in the usual way. The only remaining items now to be considered are the floating holder *113*, reamer bar *114*, and high speed reamer *115*. The floating holder is made from a bar of stock turned down to fit the turret hole and bored to receive the reamer bar. It also has a drilled hole for the driver. The allowance for making this part would not exceed 5 hr. and as it is not to be hardened there would be no grinding time considered. The bar *114* is a simple turning operation but there is a collar pinned to it at the reamer end, a pin through it for a driver, and the end that fits the reamer is a

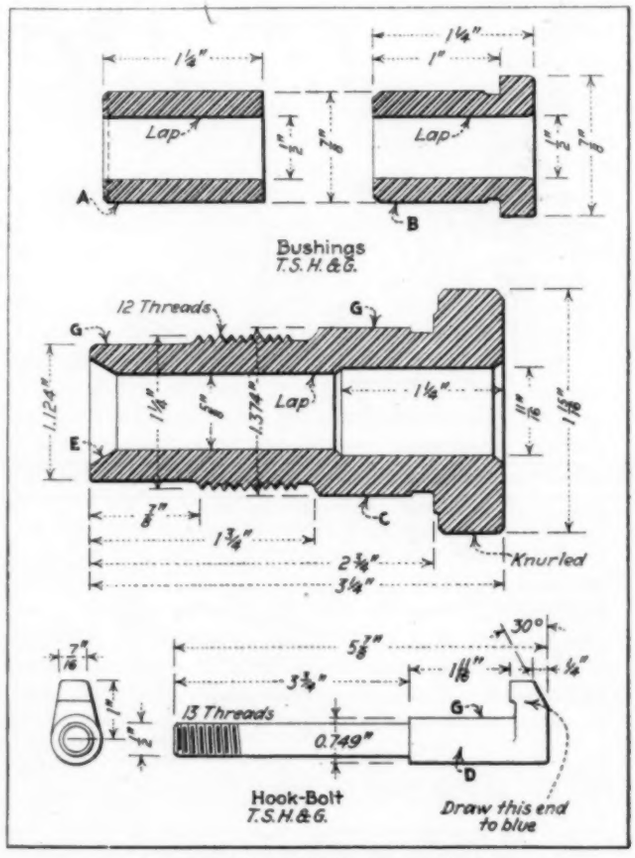


Fig. 66—Jig details for estimate

standard taper for shell reamers. About 12 hr. allowance should cover the manufacture of this bar.

In the manufacture of the reamer itself, we should consider first whether it is possible to buy it from any manufacturer of small tools or whether it must be made up in our own factory. Assuming the latter we would need first a piece of high speed steel probably 4¾ in. in diameter by 4¼ in. long. It might even be necessary

to take a larger piece and turn it down to suit if the size required were not easily procurable. A piece of high speed steel of this size would weigh in the neighborhood of 26 lb. which of course would be considered at the current rate for high speed steel. In cutting this material we should remember that the process is much slower than with machine steel or tool steel and the time allowance should be increased correspondingly. We must drill, bore and ream the taper hole, put the work on an arbor and turn up the outside diameter to the shape called for, slot one end for the driver, mill the teeth and relieve them, harden the reamer, grind the taper hole, the outside diameter, the relief and the edges of the flute.

To the estimator who is unfamiliar with the manufacture of cutting tools there are several problems involved in this example that require study. The turning and boring operations bring in no new problems except that a taper arbor for turning will be required and if this is not in stock it must be made up or purchased. The estimator should allow for such items. In the milling of the flutes several cuts on each flute will be required with a slow feed and plenty of lubricant. The allowance should be made sufficient to cover indexing time, setting up the machine and the various cuts required. A reamer of this type would have about 16 flutes and each flute would probably require 20 min. for the various roughing and finishing cuts. The grinding of the hole to a taper gage, the grinding of the outside diameter to size, the relieving of the teeth and the grinding of the cutting edges would consume in all, including the setting up time, not less than 5 hr. The time allowances for this class of work are difficult to determine in shops that do not specialize on cutting tools and in all probability much more time than that mentioned would be consumed under these conditions.

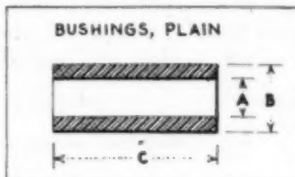
Estimating on Reamers

While we are considering the estimating process as applied to cutting tools let us take up several other types as shown in Fig. 65. The first of these is a reamer *A* of which 6 are required. This example is given on account of the small diameter and the length of the reamer which make it difficult to machine on account of its slenderness. From the time when the bar is cut off and centered, all the operation must be done at much slower speed and with lighter cuts than would ordinarily be the case. The cutting of the flutes on any taper reamer requires a certain amount of experimental setting in order to obtain a "land" of uniform width and while an experienced man will do this work rapidly, one who is not so familiar with it will spend considerable time in the process. In any case the cutting must be done slowly in order to avoid "chatter." Other operations on this piece do not require discussion.

In the example shown at *B*, we have a very large piloted taper reamer made of tool steel. This piece would probably be made from a forging and turned down after the ends had been centered and finally tapered with the taper attachment allowing from 0.015 to 0.020 in. for the final grinding. In setting up the work on the milling machine, allowances must be made to cover two or three milling cuts for each flute and as there would probably be 12 flutes or more, the cutting allowance would approximate at least 30 min. for each flute. The grinding operation also is long and the work must be carefully measured to obtain the proper taper as it is not likely that a gage for this piece would be available. The taper must be ground cylindrical first and then each tooth backed off or relieved after which the edges of the teeth are ground in the usual way. The pilot must also be ground cylindrical but the ¼-in. diameter does not require it. We should probably allow from 25-30 hr. machining and grinding time on a reamer like this in addition to the cost of the material, which would be considerable.

The next example *C* is a dove-tail forming tool of a variety common in every shop. To overcome the possibility of distortion in hardening a special kind of steel is often used. Work of this kind requires shaping to form and a templet is usually made from sheet metal of the form required. An outline of the shape is scribed on the end of the block after it has been trued up and the toolmaker works up close to this scribed line afterward using the templet as a "master" to get the exact sizes. The practice in different shops varies in this respect and the general procedure is also different. It has been found that the grinding of the entire formed face by means of suitably dressed wheels gives good results and while the cost of production is somewhat more it is offset by the long life of the tool and the accuracy of the work produced. The laying out of the work and the templet (if one is used) require considerable time dependent of course upon the intricacy of the design and the general shape of the contour. Several hours might be consumed in "coppering" and scribing the work by means of surface gages, size blocks, and other accessories. The templet also takes time that must be considered. We have already discussed the fitting of a dovetail. The grinding of the faces of the tool requires a variety of grinding wheels each of which must be dressed to shape on the machine. The setting up to obtain the clearance angles is also important and must be allowed for.

On such work as this the estimator must be a "good guesser" for it is impossible to figure the time needed. Warping of the surfaces due to hardening stresses often adds several hours to the labor involved and it is simply up to the estimator to consider all these contingencies and add enough to the estimate to cover the possibilities. Records of work previously done are invaluable.



QUANTITY	A	B	C	DATE MADE	TOTAL HOURS	AVERAGE
6	⅛	5/16	⅜	2-14-23	4.6	0.77
2	"	"	"	3-9-23	2.4	1.2
1	¼	½	1	3-10-23	1.4	1.4
4	"	"	"	3-10-23	3.9	1.0
3	⅜	¾	1⅛	1-12-22	3.6	1.2
2	"	"	"	2-23-22	2.9	1.5
12	"	"	"	2-23-22	7.2	0.6
6	5/16	"	"	1-16-20	4.8	0.8
8	½	"	"	2-12-20	4.8	0.6
2	"	"	"	4-8-23	3.0	1.5
10	"	⅜	1⅛	9-8-23	6.4	0.7
60	5/8	1	2	9-12-23	30.0	0.5
12	¾	1⅛	2¼	9-21-23	8.7	0.8
10	¾	1⅛	3	9-21-23	10.2	1.1

Fig. 67—Record of manufacturing costs for estimating department

Several jig parts taken from a detailed sheet as representing a few of the simpler problems connected with tool estimating are shown in Fig. 66. Examples *A* and *B* are respectively plain and headed drill bushings used in jigs. Estimates on bushings depend upon the method of manufacture and the degree of standardization in use in the factory where made. When made up in standard sizes the cost of production is materially reduced, but as this is seldom done we shall not consider this method. A screw machine is often used for roughing out bushings, studs and similar work when several pieces of the same kind are required, the work being drilled, reamed, rough turned and cut off

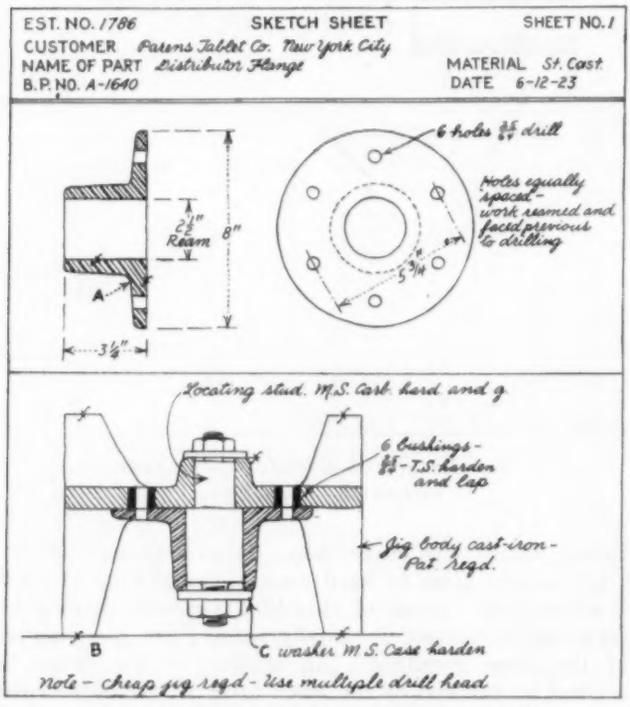

EST. NO. 1786
SKETCH SHEET
SHEET NO. 1
CUSTOMER Parens Tablet Co. New York City
NAME OF PART Distributor Flange
MATERIAL St. Cast
B.P. NO. A-1640
DATE 6-12-23
6 holes drill
Holes equally spaced - work reamed and faced previous to drilling
Ream
A
Locating stud. M.S. Carb. hard and g.
6 bushings -
T.S. harden and lap
Jig body cast-iron - Pat. Reqd.
B
C washer M.S. Case harden
Note - Cheap jig reqd - Use multiple drill head

Fig. 68—Tool sketch sheet from which estimate is required

in one operation. After this it is placed on an arbor and finish turned, formed and squared up as required on a lathe. After hardening it is ground inside and out and finally the hole is lapped. Bushings *A* and *B* are alike except that one has a head and the other is plain. The former is a trifle more costly to manufacture. If made one at a time we should allow about 1½ hr. for *A* and 2 hr. for *B*, in addition to the value of the stock, which is a small item.

In example *C* we have the most expensive kind of bushing, threaded and piloted and chamfered at one end for locating purposes. In estimating we must cut off the stock, drill and ream and relieve the hole, and chamfer one end. Then the piece must be placed on an arbor, turned, faced and the thread cut in a lathe, *E* being chamfered in the same operation. Several diameters are to be ground after hardening and the ⅝-in. hole lapped. For boring and reaming we would allow 1 hr.; for turning, threading, etc., 3 hr.; for grinding and lapping about 2½ hr.—total 6½ hr. The knurling is so short an operation that it is not considered at all.

The hook-bolt shown at *D* is generally made from a forging and not machined out of solid stock. The work would be centered and turned up to the hook bolt portion and then threaded and the ends faced off square. About 1½ hr. labor should be allowed. The work would then be milled or shaped on the hook bolt end, filed up for finish and hardened—perhaps 2 hr. labor allowance or even less with a good operator. In grinding, the large diameter can only be ground up to the hook bolt in the first setting. The end is finished by revolving the work through an arc by hand until it is reduced to the correct diameter—allow about 1 hr.; total 4½ hours.

It is wise to establish labor time on various jig details such as plain and screw bushings, hook bolts, clamps, and the like in order to simplify the estimating on such parts. A good way is to make up a card index of actual jobs on more or less standardized details of jig construction in a form similar to that shown in Fig. 67. This card is made up from records in the cost department and it includes the labor required on small bushings having holes whose diameters range from ⅛ to ¾ in. with lengths from ⅝ to 3 in. In making up the card it is advisable to pick out similar items made up in different quantities as an average can then be obtained on the time necessary to suit almost any condition. A drawing of the type of bushing or other detail is shown in the upper left hand corner of the card and two or three important dimensions are tabulated for convenient reference. It is suggested that the card be indexed alphabetically so that any given detail can be quickly obtained by running over the cards.

Estimating Without Jig Drawing

One of the most difficult problems that confronts the estimator involves a piece of work for which no jig drawing has been made. The imagination must be called into play in connection with freehand sketches in order to form an idea as to the work required and the method used. In turret lathe work boring bars, facing heads, forged tools, chuck jaws and the like are more or less standardized so that an estimate by an experienced man can be made quite easily from rough freehand sketches. In jig and fixture work, however, it is not so easy a matter, as the method of holding must be well established and the location of the work clearly indicated in order that there may be no doubt as to the feasibility of the design proposed. In such cases the estimator commonly makes a freehand sketch either on a sheet of plain paper or on a regular sketch sheet like that shown in Fig. 68.

In the example shown the work *A* is to be drilled in a jig for which no design has been made. There are six ¾-in. holes spaced equally about the center of the work and a simple jig of cheap construction is required. The estimator makes a rough sketch of the work itself for a reference and then designs the jig shown at *B*, giving various items of information in writing. From these data he makes up an estimate in the usual way.

As the pattern is a simple one with four legs on each side, an allowance of 4 hr. should be sufficient. Assuming that the body of the jig is about 10 in. square he would say it contains about 150 cu.in. of cast iron including the legs or about 40 lb. in weight. The casting must be planed twice and faced off on the boss and the six bushing holes located and bored—probably about 20 hr. labor. Six bushings at 1½ hr. each = 9 hr. Locating stud and C-washer—about 5 hr. more, including fitting. Total allowance for the jig in labor hours—about 40 hr. To this should be added material cost and cost of design—8 hours.

Machining a Worthington Pump at the Harrison Plant

By S. J. Koshkin

Continuous milling of steam and water-cylinders — Boring, facing and tapping on special boring machines — Drilling on radials and multiple-spindle machines

THE duplex piston-pumps of the general service pattern, manufactured by the Worthington Pump and Machinery Corporation, have in the smaller sizes the steam and water-cylinders as parts of the same casting. In the larger sizes the steam cylinders have cradles attached but the water cylinders are separate. In Fig. 1 is illustrated the milling of duplex steam cylinders with cradles attached on a motor-driven Ingersoll milling machine of the planer type, using four heads, two of which are on the housing and two on the cross-rail. A special gang jig, visible in the illustration, is used. The frame of the jig has four locating-points, two for the steam cylinders and two for the cradle-ends. Fourteen jig-units are attached with seven clamps to the table of the milling machine and 32 clamps and bolts are used in fixing the 14 castings.

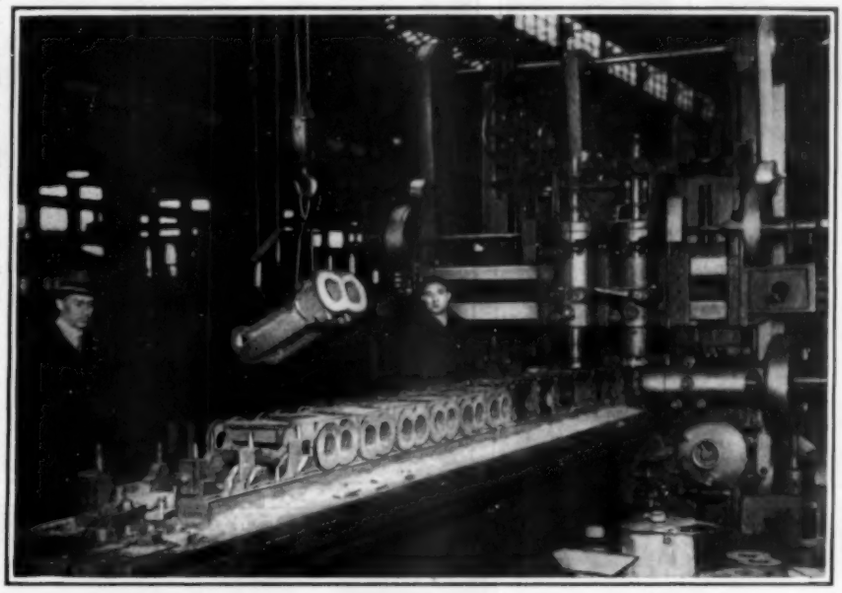


Fig. 1—Milling steam-cylinders with cradles attached

The setting of the milling heads is done in the following order:

1—The first side-head is set to take a specified amount of metal from one side, say $\frac{1}{8}$ inch.

2—The second side-head is set according to the dimensions specified on the drawing, with an allowance for the finishing cut, measuring the distance from the cutting edges of the first side-head by means of a steel rule.

3—The center of the bore of the steam cylinder is located on an inserted piece of wood with a surface gage. The surface gage is set at the required height as measured from the table by a steel rule, and the first cross-rail milling head is lowered to the required height.

4—The operation is repeated for the second cross-rail head.

About 45 minutes is required to secure the work in the machine and accurately set the milling cutters. A roughing cut is first made, the speed being regulated to the best cutting speed for the largest milling head by means of a rheostat controlling the driving motor. The finishing cut is made on the return trip of the table at the same speed or else on the next forward trip after having first used the quick return.

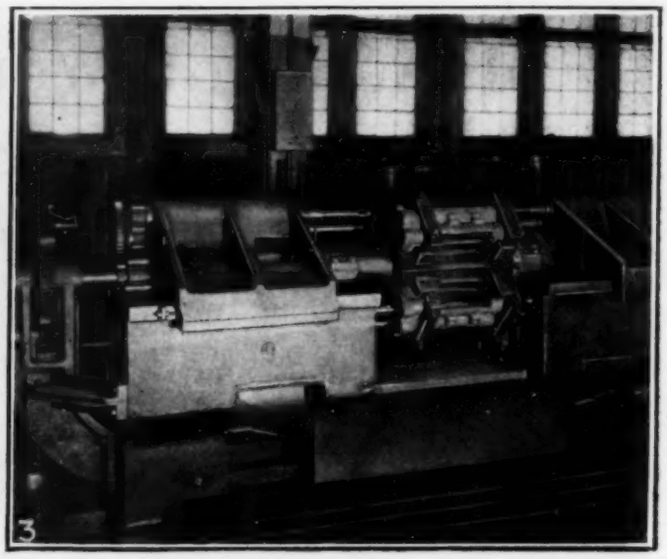
Finished castings are continually being removed from the table by the help of a crane and rough castings put by the operator in their places. This makes the milling process practically a continuous one. About eight castings are completed on this milling operation per hour.

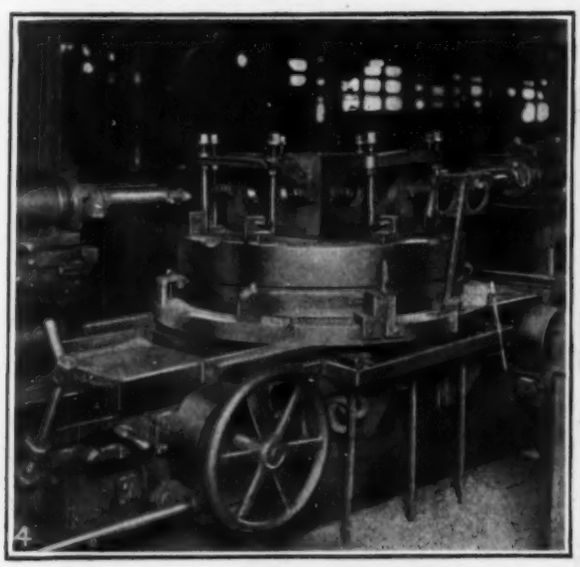
The water cylinders, or the combined steam and water-cylinders in the smaller sizes, are milled in a similar manner. The difference is mainly in the construction of the jig.

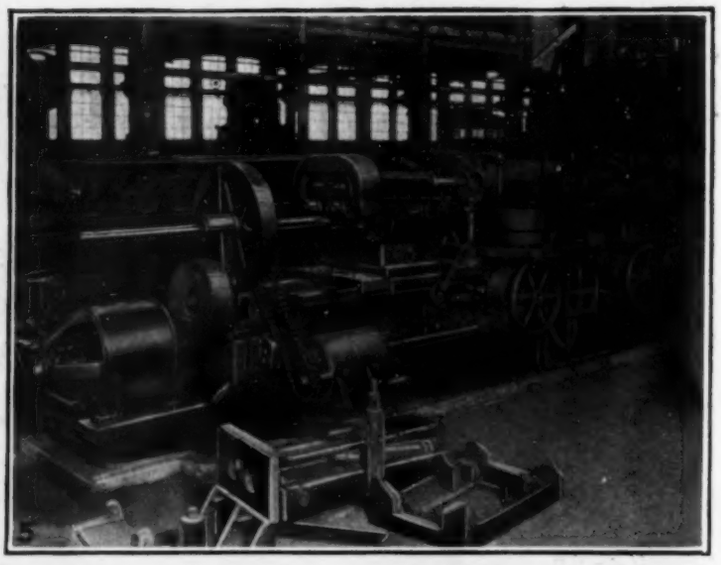
The next operations are performed on double-end horizontal boring machines having two spindles on each end. These machines are somewhat different according to the special work they have to perform. They are illustrated in Figs. 2 to 5.

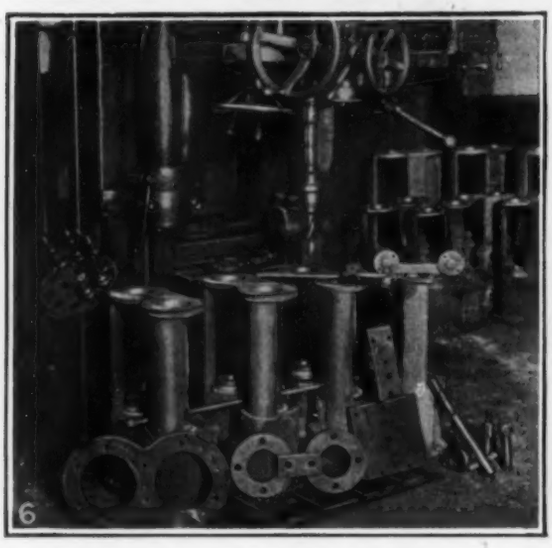
The boring machine shown in Fig. 2 was built by Beaman and Smith. It is used for the larger sizes of duplex steam cylinders with cradles attached. The work is clamped to the jig, using as locating surfaces at right angles to each other the steam-chest side of the cylinders and the end of the cradles previously finished on the milling machine. The steam cylinders and the stuffing boxes are rough-bored on the left at the same time that the cradle-end is rough-bored on the right.

Finishing heads are substituted for roughing heads and the cylinder bore and cradle ends finished. Also a









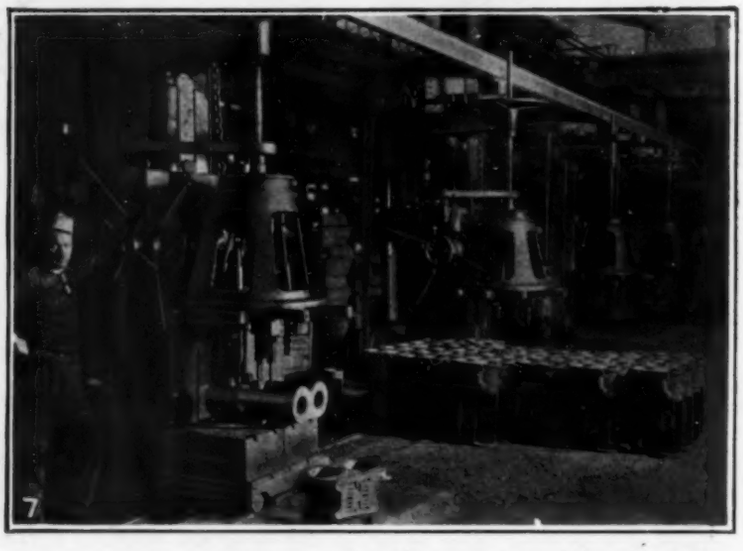


Fig. 2—Double-end horizontal boring machine with jig. Fig. 3—Semi-automatic boring machine for small sizes Fig. 4—Turret-jig for water cylinders. Fig. 5—Boring water-cylinders on turret-jig. Fig. 6—Drilling four steam-cylinders on a radial. Fig. 7—Drilling cylinders on multiple-spindle machines

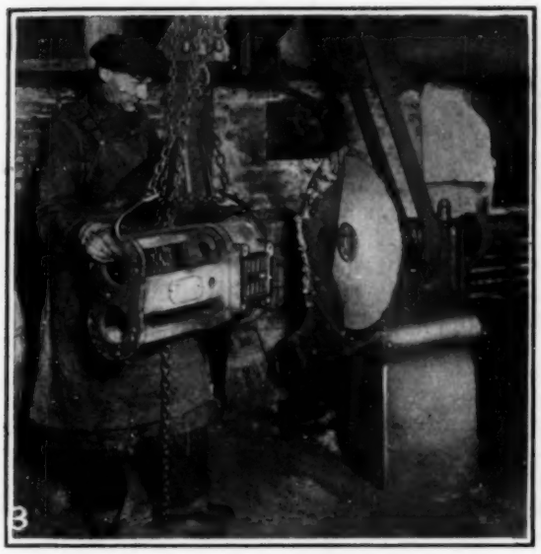


Fig. 8—Polishing the steam ports. Fig. 9—Driving in studs

slight counterbore is given to the cylinder openings.

The stuffing boxes are faced and then reamed and tapped. The boring, facing and tapping require about 40 min. per casting. After these operations the work is inspected.

The small sizes of piston pumps, in which the steam and water cylinders form parts of the same casting, are machined on semi-automatic boring machines as shown in Fig. 3. The operator has only to place the work in position, remove it when finished and replace the cutting tools when dulled by others which have been made and sharpened in the toolroom. All the motions of the machine, feed, quick return and indexing of the turret, are automatically controlled by cams.

Operates on Three Castings

The machine, which was designed and built at the Harrison plant by Worthington engineers, works continuously on three castings at a time. Two of the machines are now in operation.

The work, after having been milled on an Ingersoll milling machine, is clamped to the turret of the boring machine. This turret is operated by cams and rotates on trunnions.

The steam cylinders are completely finished on one end of the machine while the water cylinders are being simultaneously finished on the other end.

There are three sets of tools for the steam-cylinder end and also three sets for the water-cylinder end. These sets are similar in type but differently dimensioned. They are as follows:

1—Tools for rough-boring cylinder and stuffing box.

2—Tools for reaming cylinder and stuffing box and counterboring cylinder.

3—Tools for tapping stuffing box.

The water cylinders, which are cast separately from the steam cylinders in the piston pumps of larger sizes, are machined on special boring machines with a turret-jig as shown in Figs. 4 and 5.

The turret-jig to which the work is clamped takes four sets of water cylinders at a time. Each side of the square turret has locating surfaces at right angles. The work is centered by a templet, attached to the sub-base, that swings up and down and can be applied to the cylinders.

The cutting tools consist of specially designed boring bars attached to the spindles. Each boring bar carries on one head three sets of cutters giving three different diameters: the smallest for the stuffing box, the next for the rough size of the cylinder, and the last for the counterbore. All these tools are for the roughing operation.

The opposite head performs the finishing operation and is similarly arranged but with the following tools: one sliding shell-reamer, one sliding shell-tap and one set of finishing cutters.

The operator places the first pair of water cylinders in position, unlocks the turret, opens the air valve, which admits compressed air into the turret cylinder, and then turns the turret 90 deg. The compressed air, lifting the turret, makes the turning of the latter easier by removing most of the frictional resistance.

The machine is then started and the first set of water cylinders rough-bored. While this is being done the operator sets the second pair of water cylinders in place and when the roughing operation on the first pair is finished he turns the turret 90 deg., as previously described, and rough-bores the second pair, while setting the third.

Sequence of Turret Positions

When the second pair of cylinders is rough-bored, the operator, by turning the turret 90 deg. for the third time, brings the third pair in front of the roughing tools and the first pair, which was cooling off during the preceding operation, is now brought in front of the finishing head to be finish-bored.

From this time on, for each turn of the turret the operator has to remove the finished work and to replace it by another casting. In other words, each turn of the turret gives him one pair of cylinders rough-bored and another pair finished.

The drilling operations are performed in two different ways, either on 5-ft. radial drills or on multiple-spindle machines.

The larger sizes of duplex steam-cylinders with cradles attached are drilled on 5-ft. radials, four at a time, as shown in Fig. 6. No layout is necessary because all of the machine work is done by the use of special fixtures.

These jigs, shown in the illustration, as used for the following operations:

1—Drilling for studs to hold cylinder-heads.
2—Drilling cradle-ends for studs.
3—Drilling steam chest and cross-stand for studs.
4—Facing, drilling, and tapping for glands.
5—Drilling and tapping for drains (no jig).
6—Drilling and tapping for studs in stuffing boxes.

A special wrench is used for screwing flanges on stuffing boxes.

All these operations are also performed, as shown in Fig. 7, on multiple-spindle drills for the smaller sizes of duplex steam-cylinders with cradles attached. These multiple-spindle machines, set in a row, are also used for drilling the four sides of the water-cylinders.

Successive Drilling Operations

The work is mounted on a steel platform, moving along rails, by which it is brought under each drilling machine in turn. At the first machine, by using a drilling jig, a first set of holes is drilled. The work is then turned 90 deg. on the platform and brought under the next machine where a similar operation is performed. The other drilling machines perform similar operations on the two remaining sides of the casting.

In order to reduce the amount of idle time the whole lot of castings to be drilled is generally divided into two parts, one half being placed at one end of the system of four drilling machines and the other half at the other end.

The order of drilling is first in one direction, going from one drilling machine to the next until the fourth machine is reached, and then in the opposite direction. Finished castings are therefore removed at both ends of the system of drilling machines.

After the drilling operations the work is inspected for the second time. If the cylinders are O.K. in all respects they are sent to the store room.

When the erection foreman receives the order to assemble a certain number of specified units he draws out from the store room all necessary parts and then the remaining operations are performed.

Filing and Chipping

First some filing and chipping, from 15 to 20 minutes, is done preliminary to the polishing of the steam-ports. Then the polishing itself is done, as shown on Fig. 8 on a disk grinder, the work being suspended from a crane, the operator simply applying the suspended casting for a few moments to the grinder.

Then comes the studding operation. The stud holes are cleaned by compressed air and the studs for the steam chest are started in place by hand. The steam chest itself and its cover are then put in place to direct the studs and the studs are screwed home by a pneumatic studding machine illustrated in Fig. 9. Next the studs for the steam-cylinder head and the steam chest pipe-flange are put in and the head and the flange themselves are placed in position. After that the studs are screwed in by the machine.

Then the water-cylinders and all the other parts are attached to the completed steam cylinders and cradles, and the assembled pump is tested under actual working conditions. If found satisfactory the pump is painted and put on skids. A serial number is assigned to it and it is ready for shipment.

How Grinding Affects Drills—Discussion

By Roscoe A. Ammon

On page 743, Vol. 61, of the *American Machinist*, under the title given above, there is a very interesting article by Chas. F. Henry, with two photographs showing grinding checks. Mr. Henry recommends using plenty of coolant in grinding high-speed drills and he is absolutely correct if the shop is using a drill grinder with a wheel of wrong grain and grade, especially if the wheel is running too slow. Most drill grinders have wheels of too fine a grain and too hard a grade, and the wheels do not run at the proper speed for efficient cutting.

Regardless of grain, grade and speed of wheel, however, there will always be a tendency to check a drill when grinding on the side of the wheel, because all parts of the wheel surface are not traveling at the same speed, hence there is uneven wear on the wheel and uneven removal of stock from the drill. The side of the wheel does not clear itself by throwing off the used grains of abrasive as readily as does the face. As a result the side of the wheel glazes more quickly and generates more heat. The side of the wheel is more difficult to true up than the face.

The water used on a drill grinder does not come in contact with the heated part of the drill until after the drill has ceased to be in contact with the wheel. When grinding on the face of the wheel, there is sufficient air traveling on the surface of the wheel to keep the drill cool, if a wheel of the proper grain and grade is used and the wheel is running fast enough. Under these conditions there is no need to overheat a drill unless "hard" grinding is indulged in.

I have several times had to grind an inch or so off a 2- or 2½-in. broken drill, but never experienced any difficulty with the drill getting too hot, even without a drop of coolant. I used a "red" wheel No. 30-0, running close to 5,000 ft. per minute.

I was recently in a shop that does some real drilling on hard stuff and they were having trouble with drills breaking out at the point when drilling hard, molybdenum-steel forgings. The piece workers all wanted hand-ground drills on hard stuff. The drills frequently needed to be ground back ¼ in. or more and they ran from 1¼ to 2¼ in. diameter. No flaws were found in the drills. With freshly-ground drills (machine ground) grinding checks were plainly visible under a microscope. Examination of hand-ground drills did not show any checks.

There were no checks that we could find on $\frac{31}{32}$-in. machine-ground drills, but on drills from $1\frac{7}{32}$ in. up, the checks were there on over ten per cent of the drills examined, even when the wheels of the grinder were kept trued constantly.

A Correction

On page 5 of the *American Machinist* in the article "Some Elementary Facts About Hardening" the statement was made that under the skin of every rough bar of carbon steel there is a *carbonized* surface that will not harden. The word carbonized should have been *decarbonized*, inasmuch as the point being made by the author was that there should be enough stock that the decarbonized surface could be removed by machining.

A Gear Cutting Hob of Novel Construction

Special Correspondence

The hob is made up of five sections—Each section is a separate drop-forging—The cutting edges are inserted tool bits — Sections are interchangeable

A NEW ENGLAND manufacturer* that for many years has been engaged in the business of supplying machine shops with cutting tools for lathe, planer and milling machine has recently developed a hob for cutting the teeth of large gears that is of more than passing interest to mechanics, not only because of the novelty of its construction but as well for the unusual methods and fixtures applied to its production.

Each section of the hob is a single drop-forging, comprising one turn of the helix. One section may be seen in Fig. 1, together with the dies in which it was produced. The forgings are of a special grade of steel that may be toughened by quenching in oil but does not harden.

The first operation is to drill and ream the central

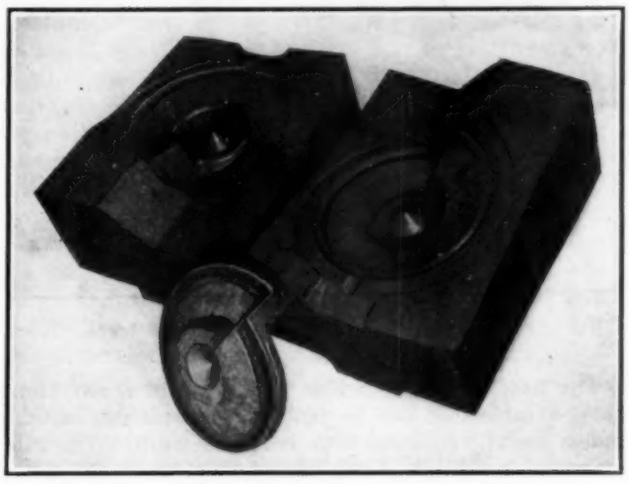


Fig. 1—Drop-dies and forging

hole. The work is done in a drill-press with the piece held in a special fixture. A depression in the center of the forging, made by the drop-die, facilitates starting the drill, and the work is completed in about the time that would ordinarily be required to chuck a forging of the same shape.

It is then mounted on an expanding arbor, swung between centers in a lathe and the ends of the hub faced to length. This latter is one of the few operations in which exact measurements are required, as the length of hub must be exactly equal to the advance of one turn of the helix.

As the forgings come from the drop-dies there is a rib of material, necessary to the forging but not wanted in the hob, connecting opposite ends of the helix in a diagonal line. It is removed at this stage by a milling cutter shaped roughly to conform to the space between the turns.

The second operation to require more than ordinary

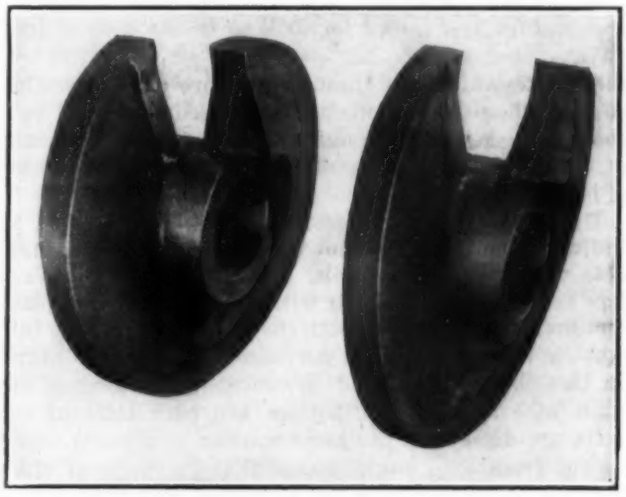


Fig. 2—Sections of large hob

care is planing the ends of the turn of helix; both of which must lie in exactly the same radial plane. When properly machined the sections are symmetrical and may be turned around or transposed in any manner without disturbing the continuity of the helix.

As the turn of helix overhangs by one-half its thickness the face of the hub at each end, it is necessary to finish the outer diameter of the latter in order to allow it to pass under the overhang and bring the faces of the hub together. This work is done with a large end mill while the section is mounted on the centers of a dividing head set up as for generating the helix. The ends of the turn are then planed in a shaper. Fig. 2 shows two of the sections at this stage.

To hold the sections in relation to each other two radial keys are let into the face of all the hubs. The work is located for this operation from the planed ends of the turn of helix so that the keys joining any two sections will engage when the respective sections abut against each other. To bind all the sections together four bolts are equidistantly spaced around and parallel with the axis of the hub.

All bolt-holes are counterbored at both ends for the bolt heads and nuts so that any section may occupy either end position without interference. A longi-

*The O. K. Tool Holder Co., Shelton, Conn.

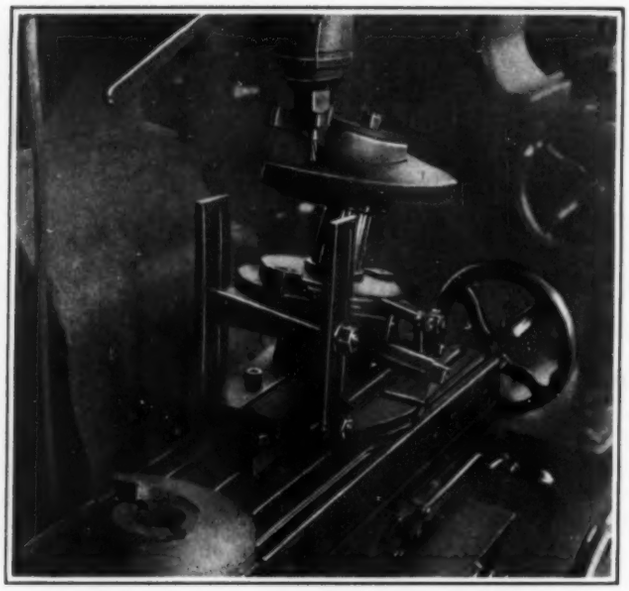


Fig. 3—Fixture for drilling the sections

tudinal keyway is cut through the bore of each section so that when the sections are assembled there will be a continuous keyway through the entire bore by means of which the hob may be secured to the arbor on which it is to be used.

Up to this point the sections have been handled as individual units; each unit identical and interchangeable with every other unit. Five of the sections are now assembled on an arbor with the radial keys in place and are drawn together with the four binding bolts into what is to all intents and purposes a single-piece worm. In this shape it is placed on centers in a standard engine lathe and the top, bottom and both sides of the helix are dressed in the same manner as a worm would be cut from solid stock, except that the work of stock removal is avoided and the lathe tool has but to take a "skim chip" over the contour.

Exceptional accuracy in turning the helix is not necessary, hence any engine lathe that can be geared to the right pitch is good enough for the job. If the helix were to vary—even as much as $\frac{1}{8}$ in.—from true lead it would not seriously affect the result. As a matter of fact, however, the lead is always made as nearly perfect as a good engine lathe will cut it.

The embryo hob may now be visualized as a large worm with approximately true lead, but somewhat smaller than the finished hob is to be. It is then disassembled

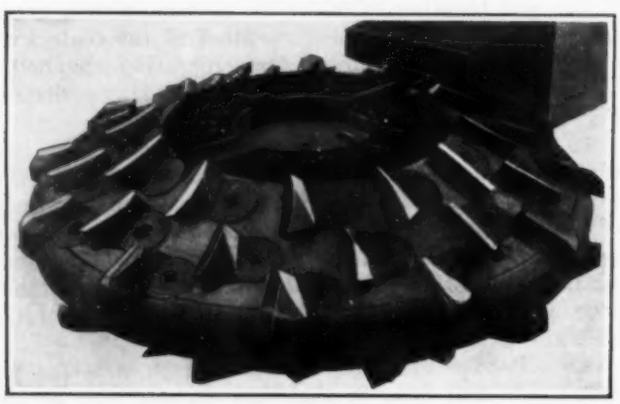


Fig. 4—Showing how the teeth are held in the body

and the sections go to the fixture shown in Fig. 3, where the holes are drilled in the sides of the helix for the shanks of the toolbits that are to become the cutting teeth of the hob, and for the circular locking wedges and bolts that are to hold them in place.

At the time the photographs illustrating this article were made there was none of the larger sizes of hob in process, and we will therefore refer to Fig. 4—which represents a single-disk stocking cutter to cut gears of $5\frac{1}{2}$-in. circular pitch—to show the method of holding the teeth in the body.

The teeth of the hob are O. K. toolbits, die-forged to the shape required. Holes are drilled and reamed in the body of the hob to receive the round shanks and a pocket is milled at each hole into which the forged head fits. Beside each tooth position a hole is drilled and tapped for a bolt to hold the circular locking wedge and the upper part of the hole is counterbored to receive the wedge itself.

The locking wedge is a disk of hardened steel, flatted off at one portion of its periphery to correspond with the shape of the head of the toolbit. The toolbits are all ground to gage and are interchangeable, though not all are of the same shape above the pocket.

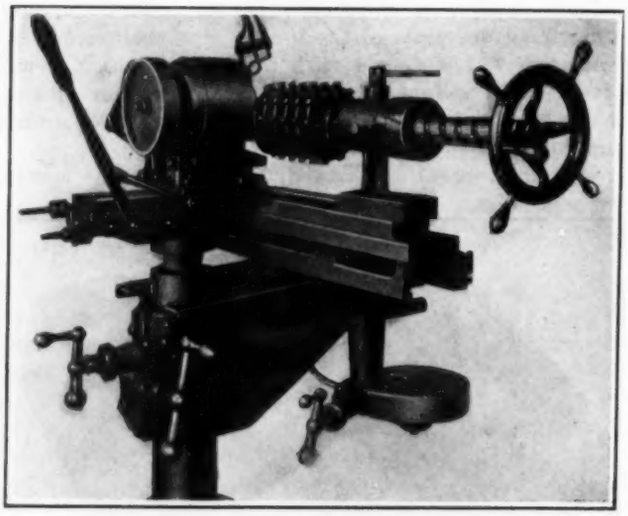


Fig. 5—Machine for grinding the teeth

The fixture shown in Fig. 3 consists of a swivelling base, a table that can be tilted in two planes, suitable index plates and a stud to hold the work. The stud is cut with a single Acme thread corresponding in lead to the hob to be drilled. Separate studs are provided for each different lead.

The index plate is splined to the stud but is free to slide endwise thereon, so that as the plate and stud are revolved together the plate continues to lie close to the table while the stud, carrying the work, rises in accordance with the lead of its screw. The tilting table is adjusted to bring the side of the helix level in both planes at a point directly under the spindle of the machine.

The object of the thread in the work-holding stud is to maintain the distance from the work to the machine spindle so that the stop of the latter may be depended upon to gage the depth of the holes. The machine is a standard vertical miller.

After the holes for the tool shanks are drilled and the pockets milled, a resetting of the fixture is necessary to drill the holes for the holding bolts and counterbore

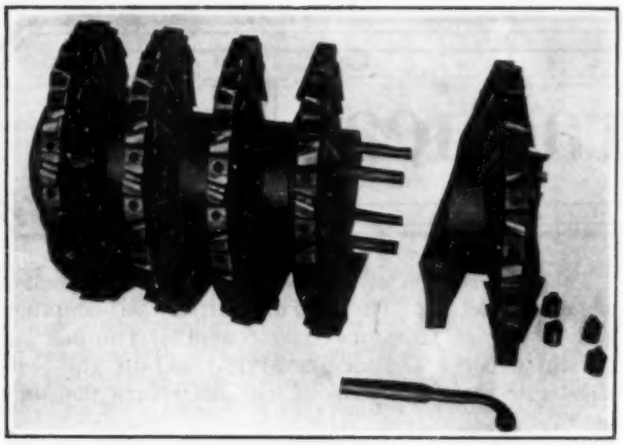


Fig. 6—Small hob, partly disassembled

them for the locking wedges. After each drilling and before moving the work the bolt holes are again counterbored to a smaller diameter for a short distance below the large counterbore, and are then tapped.

The bolts that hold the locking wedges in the large hobs and cutters are hollow head machine screws, the head being counterbored into the surface of the wedge and flush with it. As each bolt is put into its wedge a collar is screwed on the body of the bolt below the wedge and is brazed in place. The bolt cannot thereafter be taken out of the wedge without breaking it, but is free to turn. When the wedge is drawn into place the collar on the bolt fills the smaller counterbored space mentioned in the preceding paragraph, and its object is to force out the wedge when the bolt is withdrawn.

A movable jig is used for drilling the holes for the tool shanks and wedge bolts on the periphery of the sections. In this jig the work is held with its axis horizontal. Instead of a resetting after the holes are drilled for the tool shank the bolt holes are drilled at the same setting by displacing the jig sidewise and bringing into service a turnover leaf to locate the bolt hole.

The bolt hole is not radial, but is parallel with the hole for the tool shank. The same method of securing the teeth is employed except that the locking wedge is rectangular instead of round and the pockets are cut on a milling machine.

After setting in and securing the teeth, five of the sections are assembled on an arbor with the radial keys and binding bolts in place and the hob goes to the special grinding machine shown in Fig. 5, which was devised for the purpose of grinding the tooth contour.

Originally a standard cutter grinder, various attachments, including a motor driven spindle carrying a pencil wheel, have been added to adapt the machine to its work. The hob shown in place is a single-piece hob with teeth set in slots milled in the body, but the work of grinding is identical in principle with that employed on the larger ones.

The first operation is to produce a true lead and establish the correct tooth contour, but without relief. For this purpose the hob is mounted upon a long bar that is supported by two bearings, the outboard bearing being plain and the main bearing fitted with a rotatable sleeve having an enlarged end with small holes drilled radially into it to act as an index plate.

Each bar—there is a bar and sleeve for each lead—is threaded to its sleeve so that when the latter is held stationary by the index pin and the bar rotated, the hob travels back and forth over the grinding wheel in a path determined by the thread on the bar. The table has no part in this movement.

If each hob tooth were in one piece and radially disposed to the body the backing-off would be a very simple matter, but as all teeth are given a 15 deg. rake angle, further complicated by the fact that on the large hobs with multiple rows of teeth there is nowhere on the hob a *complete* tooth contour, the problem becomes considerably involved.

After grinding the tooth contour to shape the individual teeth are backed off in the following manner. By a movement which is a combination of rotating the threaded carrier bar and indexing by means of the sleeve, each toolbit is located in turn with its cutting face horizontal. The table of the machine is then raised until the center line of the wheel spindle coincides with the plane of the tooth or part of a tooth to be ground. Once set for any one tooth the bar is locked against relative rotation and the further movements are made with the index.

By means of the hand lever the wheel head is given a movement that passes it in a straight line over the side of the tooth at an angle of 5 deg. more than the helix angle. The direction of this movement is adjustable to adapt it to hobs of different lead, or to secure greater or less relief. It is analogous to backing off an ordinary side or angular milling cutter on a standard cutter grinder.

Three prime advantages are claimed for this method of construction: When the teeth of the middle section are dull the sections may be transposed to bring first one and then the other of the end sections to the middle. If a tooth is accidentally broken it may be replaced without difficulty. When the teeth have been so reduced by wear as to be no longer serviceable, they may all be replaced and the hob reground at slight expense.

A further advantage is that the cut is distributed over many small teeth, lying in different radial planes, instead of devolving upon a comparatively few larger ones, and the intermittent action noticeable in all large gear cutters is reduced.

In Fig. 6 may be seen one of the smallest hobs that is made in sections. It has but three rows of teeth, whereas the largest ones have seven rows. The hobs are made to cut 2, 1½, 1¼ and 1 diametral pitch respectively.

Use of Ethyl Gasoline Not Dangerous

Tests, recently published by the Bureau of Mines, extending over a period of months, find no dangers from the exhaust gases of engines using ethyl-treated gasoline. The tests were conducted on dogs and pigs in quite large numbers, without harmful results. Observations indicate that about 75 per cent of the infected air is exhaled so that only 25 per cent remains in the system.

The only danger of lead poisoning from products of combustion from ethyl gasoline seems to be confined possibly to the mechanic who is constantly cleaning carbon from motors using this fuel. While this is but a possibility, it merits precaution, although the occupation would appear to be no more hazardous than painting, lead being the common base of many paints.

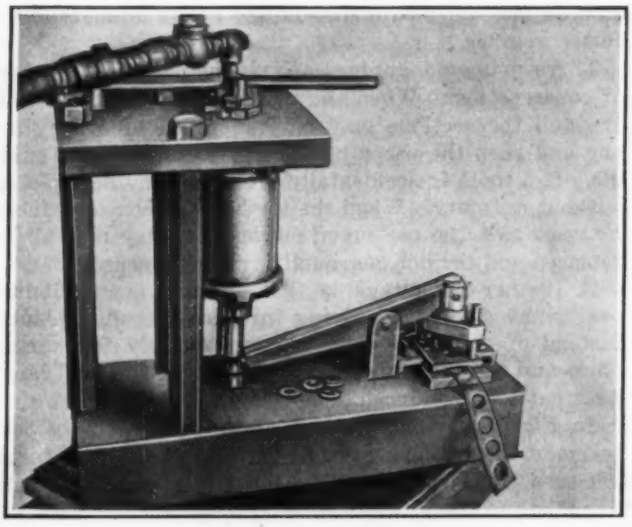
Ideas from Practical Men

A Pneumatic Punch for Cutting Leather Washers

By Jack Williams

In a railroad shop, where the number of leather washers of a given size runs into hundreds and thousands, and where the toolroom attendant or some other unfortunate fellow is expected to hand them out by the dozens at anybody's call, the job of cutting them in the usual way is apt to get monotonous—not to say tiresome. The device here shown was rigged up by the toolroom foreman and is kept on a shelf near the window. When someone calls for a dozen washers, the attendant can slip in the proper size of tool and hand them out while he is passing the time of day with the applicant.

The machine was made of odds and ends picked up around the shop, and was built in spare moments when business at the window was slack. The base and



A pneumatic washer-cutter

bracket are pieces of cast iron, planed on both sides. The separators are pieces of cold-rolled hexagon steel, faced square and to equal length and tapped at both ends for $\frac{3}{8}$-in. capscrews. The holes in the base are counterbored on the under side to let in the heads of the screws. The air cylinder is a piece of heavy brass pipe with the heads screwed in.

The tools are the most fussy part of the job, though they are not really expensive to make. They are the usual type of compound washer tools, with a shedder in the upper die to knock out the washers, and of course have the disadvantage of cutting only one size of washer with one diameter of hole. However, as they are used only to cut leather they are long-lived, and the cost of making a set is far less than would be the cost of cutting out, with any form of rotary tool, the number of washers that can be made with one set of tools.

The construction of the device is obvious, except in one or two details. The tools are entirely self-contained, and to change from one size to another one has only to slip out the shackle-pin at the end of the lever, substitute the proper size of tool and return the pin to place.

The cylinder is double acting and the air is admitted and exhausted by a small slide valve, manipulated by the lever on top of the bracket. The inlet pipe is connected by a hose to the shop air line.

With this device the tool room attendant can cut washers as fast as he can move the valve back and forth and feed the leather strip through the tools.

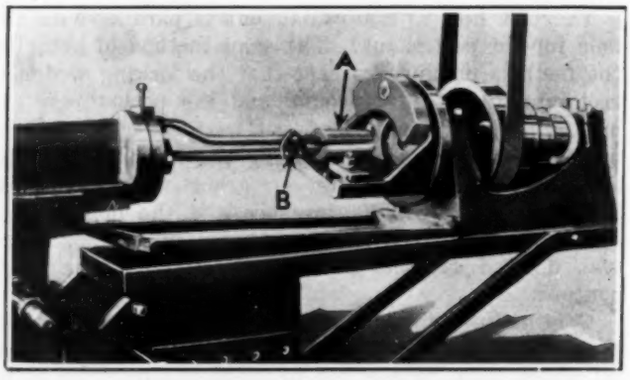
Lapping Air Cylinders

By Herbert F. Crawford

Many printing presses use air cylinders to cushion the reversal of a reciprocating table or other part. The device shown is for lapping air cushioning cylinders for the presses built by the Kelly Press Division of the American Type Founders Co., at Elizabeth, N. J., in order to secure the best surface possible for the cup leathers to work on.

The air cylinder is held on the counterbalanced angle-plate fixture on the faceplate of an old lathe headstock that has been mounted on a plate and fastened to the table of an equally old shaper. The outer end is supported by angle braces as can be seen.

The lap *A* is composed of two pieces of hard wood,



An improvised lapping machine

each half being mounted on one arm of its support. The arms are adjustable so that the halves can be separated to maintain the desired diameter of the lap, and are held at the ends by the clamp *B*.

With the cylinder in place in the fixture, the lap is entered and moved back and forth in the cylinder while the cylinder is being revolved by the lathe head. This arrangement has proved very satisfactory and provides a special machine at low cost.

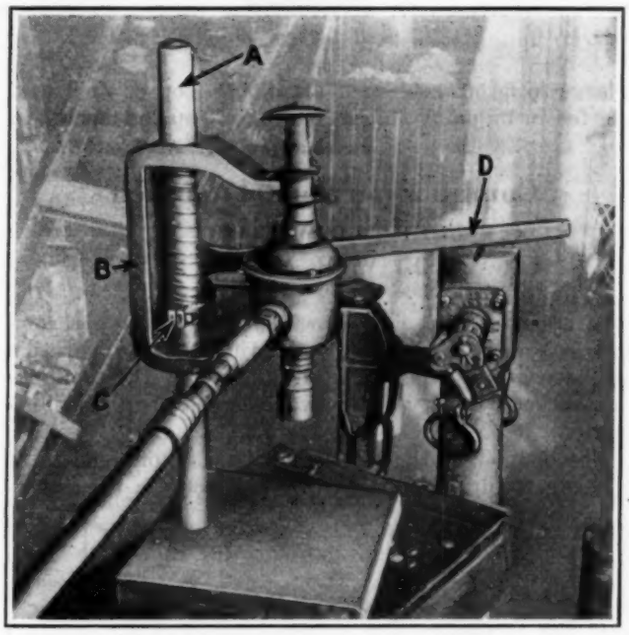
IDEAS FROM PRACTICAL MEN

A Portable Sensitive Drill

By Jack Williams

An "air-drill" of the kind commonly used in railroad and similar shops is here shown converted into a small, portable, sensitive drill without in any way altering or adding to it or interfering with its availability for use in the regular way, for it can be detached from and reset into the frame in a very few seconds.

A rectangular piece of cast iron about 1½ in. thick, planed on both sides, and the shouldered post *A* tightly screwed into it near one edge, forms the base and



An improvised sensitive drill

upright. The post is of machinery steel, turned and finished, and can be of any desired height. The frame *B* is made of flat bar stock, drilled and reamed through both arms to slide freely on the post, but without appreciable shake.

A large hole is bored near the outer end of the lower projecting member of the frame into which the air drill is set, while the upper member is notched to receive the extension of the motor case, where it is held against tipping over and falling out by tying it back with a piece of belt lace.

A clamp collar *C* fits over the post and can be clamped in any desired position by means of its clamping screw. A coil spring surrounds the post above the collar and presses against the top member of the frame. It will be seen that the frame will slide up and down the post as far as the collar and spring will let it go, and that it will normally remain in the upper position because of the action of the spring.

The lever *D* is fulcrumed to the collar by a short link. The handle of the drill that is opposite the air inlet fits loosely in a hole in the lever. By adjusting the collar up or down any desired amount of clearance within the limits of the post may be obtained between drill point and table.

The lever provides an easy and convenient means of feeding the drill to the work. By selecting a coil spring of the proper tension, any amount of overbalance may be obtained.

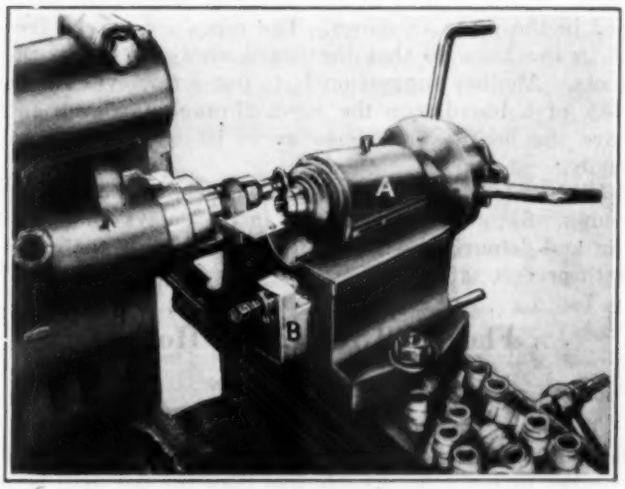
Fixture for Milling Helical Grooves

By William Denton

The pieces shown on the table of the milling machine in the illustration have helical oil grooves cut upon their conical surfaces. The operation had been done in a lathe, but because of the hard material, the steep pitch of the helix and the necessity for using a set-over tailstock, or a taper attachment—the latter involving the tying up of a toolroom lathe—the work was too slow and expensive.

The fixture for holding the work is complete in itself, and can be used on any milling machine. The work-holding spindle takes its bearing in the slide *A*, which is gibbed to the base of the fixture. The angle of the slide in relation to the locating rib on the bottom of the fixture is complementary to the helix angle of the groove to be cut, and the inclination of the spindle is the same as the angle of the taper on the work.

The work spindle has an enlarged shoulder inside the head upon which is cut two or three turns of square-



Device for milling helical grooves on conical surfaces

sectioned thread of the same lead as the helix of the oil groove. A cell, drilled into the base of the fixture at a right angle to the axis of the spindle, contains a spring actuated plunger that extends through a suitably shaped slot in the slide, and engages the thread as a segmental nut.

When the spindle is turned by means of the bent handles, the segmental nut and thread cause the slide and the work to advance. A draw-in collet holds the work in the spindle.

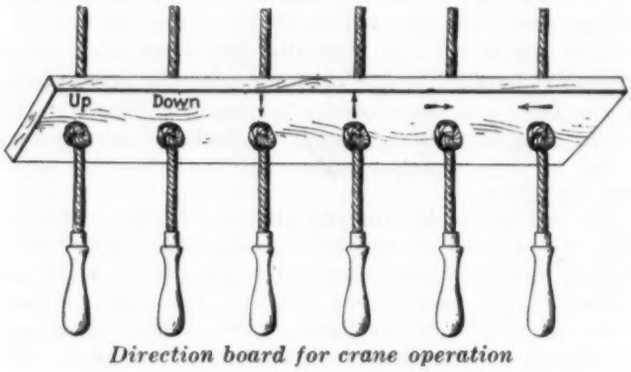
With a piece of work in the collet, the table of the machine is traversed against a stop, bringing the work to the cutter. The work spindle is then turned until the slide meets the adjustable stop *B* attached to the base; when the work is finished. The output is several times faster than could be secured from a lathe, and a skilled workman is not necessary.

IDEAS FROM PRACTICAL MEN

Preventing Mistakes in Using Controlled Cranes

By Charles F. Henry

The new foundry building of the Hoover Co., North Canton, Ohio, has a floor-controlled crane with the usual pull ropes that direct its various functions. In order to prevent mistakes on the part of those who do not



Direction board for crane operation

use the crane regularly, one of the men made the board shown, to make clear to anyone the use of each rope.

The ropes were slipped through the holes in the board, which is held at a convenient height by knots tied in the ropes as shown. The ropes are a very free fit in the holes so that the board always rests on the knots. Another suggestion is to put screw eyes in the back of a board, run the ropes through the eyes and have the board vertical, so as to be seen even more easily.

With this simple device any one who can read and knows what arrows mean (and in these days of flivvering and detouring, who does not) can handle the crane with perfect safety.

Flat Drill for Cored Holes

By F. M. A'Hearn

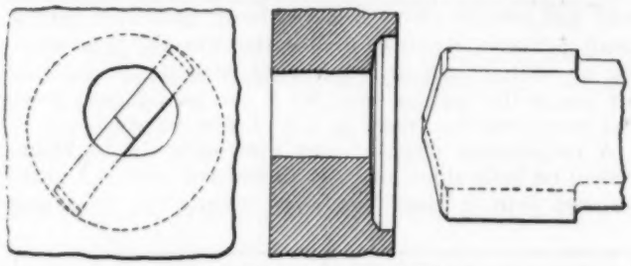
The lathe or boring mill hand assigned to a miscellaneous line of work will find difficulty in securing a cheaper or more serviceable tool than the flat drill here illustrated, which is intended for rough boring cored holes in cast iron.

A bar of tool steel of suitable dimensions, either forged smaller a few inches back of the cutting end or fullered to a greater width at the cutting end for clearance, will make a suitable blank. The blank should be turned to the required diameter and backed off slightly to prevent binding in the hole.

Attention is called to the shape of the cutting edge, this being for almost an end cut. The corners are slightly chamfered or rounded to prevent heating and burning.

In using the drill, it will be found convenient to tool out the face of the piece to the diameter of the drill. In following up with the drill, the tendency to crowd sidewise and follow the rough cored hole will be found to be practically overcome.

The drill may be clamped in the four-stud toolpost of



A flat drill for cored holes

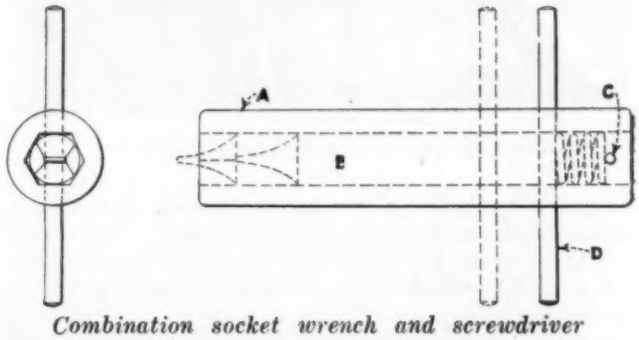
a large lathe or held with a toolpost loop or drill rest and fed in by using the tail stock, on smaller machines.

Combination Socket Wrench and Screwdriver

By W. H. Moore
Montreal, Canada

In assembling a part in which rows of stop screws and lock nuts are placed and adjusted, the operation has been greatly speeded up by the use of the combination socket wrench and screwdriver shown in the illustration.

The body *A* of the tool is broached at one end to fit a hexagon nut. Sliding within the body is the screw-



Combination socket wrench and screwdriver

driver *B*. Between the upper end of the screwdriver and the pin *C*, is a coil spring. The cross handle *D* is driven into the end of the screwdriver, passing through a slot in the body *A*.

Normally the tool is a screwdriver, the blade being pushed out by the spring. To use the tool as a socket wrench, the handle is pulled back, withdrawing the screwdriver within the body and allowing the wrench to be placed over the nut. The change from screwdriver to wrench is made in a natural manner, since the tool is held in the palm of the hand and the fingers can readily grasp the handle and pull it back. The advantage of the tool is that both screws and nuts can be adjusted without changing the position of the hand.

The department, "Ideas from Practical Men," is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for at space rates.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Machining Monel Metal

Q. Can you tell me the best method of machining Monel metal? Should it be finished by grinding or can it be given a lathe finish?. The specifications call for a limit of 0.00005 inch.

A. Monel metal can be machined by either turning, planing, milling or grinding. As to which method is the better will depend on the finish and accuracy required. An accuracy of 0.0005 can be obtained only by grinding, since it is impossible to work to such a close limit with cutting tools.

We suggest that you read the article "Machining Monel-Metal Castings," on page 341, Vol. 53, of the *American Machinist*. This article will give you information as to shapes and angles of tools, and the feeds and speeds to use.

Hardening Broaches

Q. I am having trouble in hardening broaches and form tools without cracking. I am using both Jessop's and Titanic steels. Can you tell me how to prevent the cracking?

A. In order to give you any intelligent instructions as to how to prevent cracking of broaches and form tools in hardening, it would be necessary for us to have quite a lot of information concerning your work and methods.

We know of nothing wrong with the steels you are using. If you will write to the makers of the steels, stating fully and in detail your difficulties, they will probably be able to put you on the right track.

Cleaning Reamer Flutes

Q. How are the flutes of reamers cleaned after hardening?

A. If reamers are heated for hardening in a bath of molten lead or salt, there will be no necessity for cleaning the flutes.

When it is necessary to clean the flutes, the work can be done either by sandblasting or by buffing with a wheel shaped the same as the flutes.

Brass May Be Cheaper than Steel

Q. We are having trouble with our screw-machine products rusting. The material used is free-cutting bessemer screw stock, and if the parts are stored for any length of time they rust. We have tried oiling, lacquering and even nickel plating, but none of these prevent ultimate rusting.

My contention is that it would be as cheap for us to make the parts of brass and thus avoid the trouble from rusting. The management's argument against this is that brass costs four times as much as steel, therefore the expense would be prohibitive. Have you any data concerning the comparative costs of screw machine products of steel and brass?

A. The article "Reducing Screw Machine Product Costs by Substituting Brass for Steel," published on page 823, Vol. 58, of the *American Machinist* will give you considerable data on the subject and should help sustain your contention.

Should you continue the use of steel, it might pay you to look into the process of Parkerizing. You will find, on page 361, Vol. 57, of the *American Machinist*, an article on "Parkerizing—A Rustproofing Process," which we believe will be of considerable interest to you.

A Problem in Physics

Q. We have two flanged pipes of the same size bolted together with a plate between them. In one pipe there is a pressure of 150 lb. per sq.in. and in the other 125 lb. What is the pressure on the bolts?

A. The pressure on the bolts in pounds is 150 times the square inches contained in the sectional area of the pipe. The pressure on each bolt is the result of the above calculation, divided by the number of bolts.

Variation in Pipe Diameters

Q. Why do the actual inside diameters of small iron or steel pipe vary so much from the nominal diameters.

A. The discrepancy in pipe sizes mentioned by you, is the result of attempts made to standardize pipe sizes in England, many years ago.

In adopting standards, lighter metal was decided upon for some of the smaller sizes, but the original outside diameters were retained so that existing dies and taps could be used, and so that the sizes of fittings would not have to be changed.

Preventing Cracks from Spreading

Q. If a machine frame has started to crack, either from shrinkage strains or heavy usage, can the crack be stopped from going any further by drilling a hole through the metal at the end of the crack?

A. Drilling a hole through a cracked casting at the end of the crack will often prevent the crack from extending further.

As an additional precaution we would advise repairing the cracked part by welding, either by gas or the electric arc. If welding is not possible, put as many straps as you can across the crack. Put them on hot so they will draw the edges of the crack closer as they shrink in cooling.

Tap Standards

Q. Is there any standard for the taper or chamfer on the ends of taps?

A. We do not know of any such standard.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Time Study, or Motion Study?

THE merry war between enthusiasts on the subject of time study and those who believe in motion study has been going on for several years and, according to the latest report, is still going on, but with no casualties on either side.

The casual observer meanwhile wonders why there should be any war at all. To him it seems that the two systems are parallel, each with its own virtues and its own limitations, and that in many cases one system will produce the best results, in other cases the other system, and under still other conditions both systems combined. He can see no reason why both should not live side by side in perfect friendship even though, to a small extent, they may be competitive once in a while. He can see no more reason for dropping one or the other of the two systems than he see in the discussion as to whether cows or chickens should be killed off. The way he would look at it is not that cows are a flat failure when it comes to laying eggs and that chickens are very poor milk producers, but by the reverse mental process he would look at the good we get out of both kinds of animals.

So far as the argument has gone, it seems that the adherents of motion study have somewhat the better of it; but that may be because this system up to now has been applied by people who understand what they are doing, whereas time study, to a large extent, has been in the hands of people who either did not have the proper understanding as to what time study meant or else did not have the necessary knowledge to apply it. Time study may be compared to Abrams' electronic system—at least in one way: an unbelievable number of experts sprang up overnight. We hasten to say, however, that time study was by no means the product of quacks; it has great intrinsic merit.

Where we want to get the best results of doing a job on a big planer or big boring mill—a job on which the machine and the tool do the major part of the work whereas the workman is merely controlling it—there motion study can do little good. Any number of operations could be mentioned where this is the case. On the other hand, where most of the work is done by the operator and without the help of machinery, there motion study is of prime importance; and again, where both machine and workman have to do about equal parts of the total work performed, there both time study and motion study would be in order.

The reason why time study got a black eye—two black eyes, in fact—and is now often blindly staggering around, is that so many people have undertaken time study without knowing what it means and without the necessary knowledge to do it. A proper time study divides the work to be done into its elements and then analyzes each of the elements by itself, devises the proper ways of reducing the time required for each element, whether this be by providing the proper tools or indicators or gages or chucks or tables for work or the proper position for the workman or what-not, and then gathers these elements together again and builds up the complete operation. It does not stop even at this: it gathers all the different ways in which the operation can be performed, compares them, and selects the best.

The more common way of carrying out time study is merely to send a young chap armed with a board, a piece of ruled paper and a stop watch, observe the man who is doing some job, and then either take that time as being the proper time or else have somebody make a guess as to what the proper time should be. Such a time study man is merely a refined time keeper.

It is a great pity that the wonderful results that can be obtained from time study are not reaped because it has been a failure in the hands of people who wrongfully claim to be experts.

Promoting the Use of the Air Mail

IF YOU are not already acquainted with them you should investigate the activities of the Air Mail Extension Committee. Formed by representative business men at the suggestion of the Post Office Department to encourage the use of the only really practical commercial application of the airplane in this country, the committee is doing good work in bringing the service offered by the Air Mail to American business and industry.

Habits are hard things to overcome and the habit of the business man to use the old mail facilities is no exception. One would expect that any transport medium that could save the better part of a business day in the time of delivery of an important letter to a point as near New York as Milwaukee, would be accepted eagerly by everyone. Yet the use of the new facilities is growing rather slowly.

A study of the relative transit times of airplane and railroad mails to cities far from the air routes indicates that other mail routes should be established. Nothing can be done, however, until the business man makes greater use of the facilities now existing and demands others.

The Air Mail Extension Committee probably offers the best means of co-ordinating effort in this direction.

Shop Equipment News

Sundstrand Double-Spindle Semi-Automatic Bushing-Turning Lathe

A high-production machine for turning straight cylindrical parts, that can be held in an expanding collet chuck, has been put on the market by the Rockford Tool Co., Rockford, Ill.

It has been designed primarily for turning brass, bronze and similar materials requiring high spindle speeds, but can be adapted to other work by a minor motor change and the addition of a special countershaft between the motor and the spindles.

A 5-hp., 1,150-r.p.m., double-pulley type motor, with its starting equipment, is mounted in the box type base and is belted direct to the spindles. From the left-hand spindle power is transmitted by belt to the change-gear box which, in turn, drives the feed-cam drum, mounted directly under and controlling the motions of the carriage.

The feed cams, one set of which is furnished with the machine, are designed for length of stroke, and for correct feed speeds for each step in a complete cycle to suit the requirements of the work to be done, which, at its maximum, is 6 in. in diameter and 3 in. long. Cross-feed of the tool holders is by hand with screws equipped with micrometer dials.

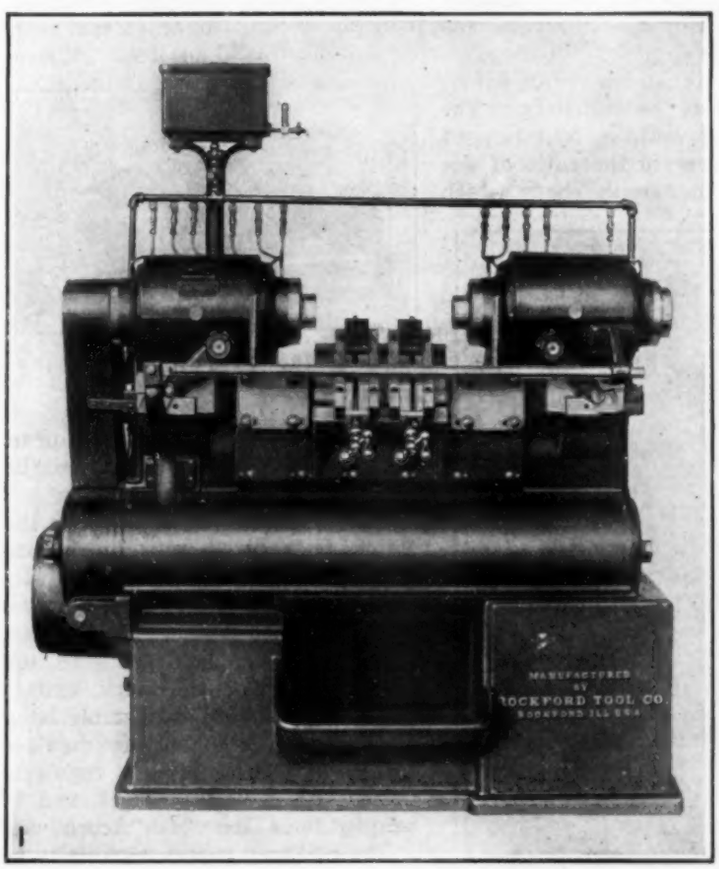
The spring chucks are controlled automatically through levers operated by adjustable cams, set on either end of the carriage, so work can be put on and removed while the spindles continue to rotate.

A central compartment, forming part of the base, catches and holds the chips for convenient removal through the front.

Features that show thoughtful design lie in the high-carbon steel, hardened, ground and lapped spindles, fitted to phosphor-bronze taper bearings, that can be adjusted by a single nut back of each spindle; in the central sight feed lubricating system as shown in the illustration; and in the 26½-in. overall length of the carriage as compared to its maximum 7 in. of travel. The quantity of oil required for each bearing can be individually adjusted.

The machine requires 40x60 in. of floor space and stands 43 in. high to the spindles. It weighs 3,735 lb. net.

The convenient location of the control levers and the inclination of the spindle housings, to bring their centers toward the front within easy reach of the operator, increases the



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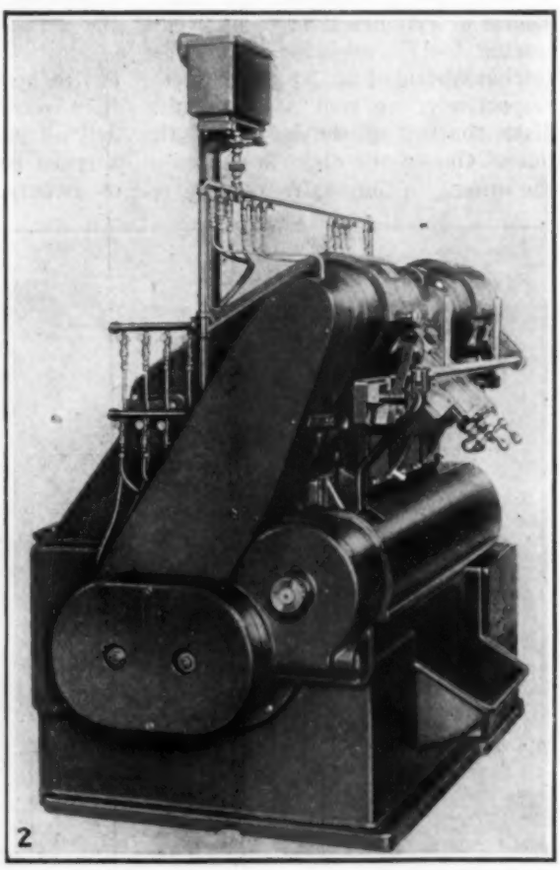
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Fig. 1—Sundstrand Double-Spindle Semi-Automatic Bushing-Turning Lathe. Fig. 2—Sundstrand lathe showing feed cam drive end

SHOP EQUIPMENT NEWS

production capacity of the machine materially.

The loose type of change gears, the provision for adequate motor ventilation, and the carriage construction completely protecting the ways from grit and chips, are valuable considerations from the standpoint of the maintenance engineer.

Work can be roughed in one spindle and finished on the return stroke to be replaced by a new piece while the same operations are performed on work in the other spindle. The travel from the end of a finish cut, on one spindle, to the start of the roughing cut on the other, can be held to a minimum by the cam design.

Société Genevoise Circular Dividing Machine

The Société Genevoise d'Instruments de Physigue, for whom the R. Y. Ferner Co., Investment Bldg., Washington, D. C., is the American agent, has recently put on the market an automatic circular dividing machine, known as "No. 0067—Model 1924." This is a bench-type machine claimed to be especially adapted to manufacturing purposes. The guaranteed accuracy of the machine is ± 6 seconds.

A heavy cross beam, adjustable in height, provides a mounting for the tracing tool, which can be adjusted to rule the graduations on plane, conical or cylindrical surfaces. This tracing tool is provided with three ratchet wheels of 20, 24 and 32 teeth, respectively, as well as with nine disks controlling the length of the lines. One of the disks is plain and the others, in four pairs, contain respectively 8, 10, 12 and 16 notches.

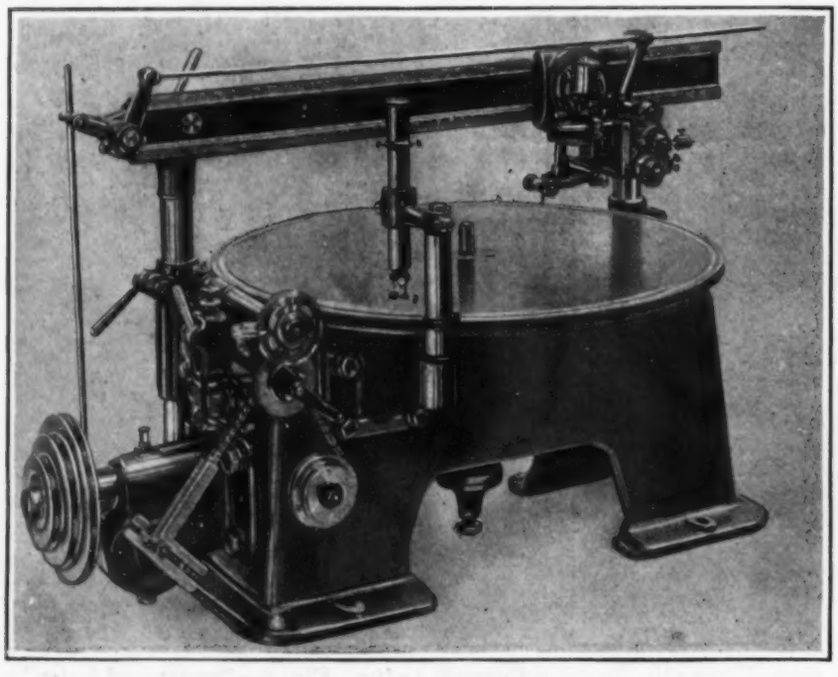
The machine is also provided with five ratchet wheels for the worm screw which operates in the teeth cut in the edge of the circular table. These ratchet wheels have respectively 50, 60, 90, 100 and 120 teeth, so that it is possible to obtain practically any style of graduation.

The table, which is 25¼ in. in diameter, has a graduation on an inlaid silver strip ruled to sixths of a degree. There is a locating microscope for reading upon this scale.

The repetition pawl-device is controlled by a chain which is rolled on the periphery of a spring case containing a spiral spring. This pawl-device is driven by a crank handle with adjustable eccentricity. The driving pulley controls, by means of a speed reducer in the ratio of one to twenty, the crank shaft which drives the worm screw and the tracelet. A driving step-pulley is provided having three diameters—3½, 5⅛ and 6¾ in., respectively, for speeds from 200 to 600 r.p.m. A motor of ⅛ hp. is required to operate the machine.

The number of teeth on the periphery of the circular table is 720, so that one revolution of the worm screw advances the table half a degree. The maximum length of line obtainable is one inch. The thickness may vary from 0.004 to 0.060 in. The depth of lines may be up to 0.04 in. From ten to thirty lines per minute may be ruled by the machine.

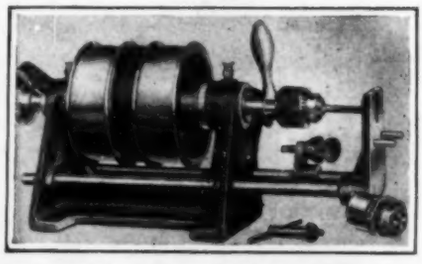
The floor space occupied is 42x26 in. The height is 28 in. The net weight of the machine is 365 pounds.



Circular Dividing Machine

Bench Tapping Machine

The Bench Machine Tool Co., 220 North 13th St., Philadelphia, Pa., has announced two sizes of production tapping machines for bench use that can also be adapted to threading and drilling. The maximum capacity of the No. 1 machine is a No. 10 tap, while the No. 2 machine, illustrated, will tap a ⅜-in. thread in cast iron, or a ⅜-in. thread in steel. A lever



Bench Machine Tool Co. Tapping Machine No. 2

control, securing central position of the spindle, allows tools to be changed without shutting down.

The hardened spindle to which the clutch is secured runs in bronze bushings that are extended inwardly to carry the two belt pulleys. The clutch is faced with "Vim" leather. A guided face plate slides in the frame to control the work, and is provided with an adjustable stop for blind-hole tapping or shoulder threading. The spindle is regularly fitted with a Jacobs chuck and is adapted for a Greenfield "Acorn" die.

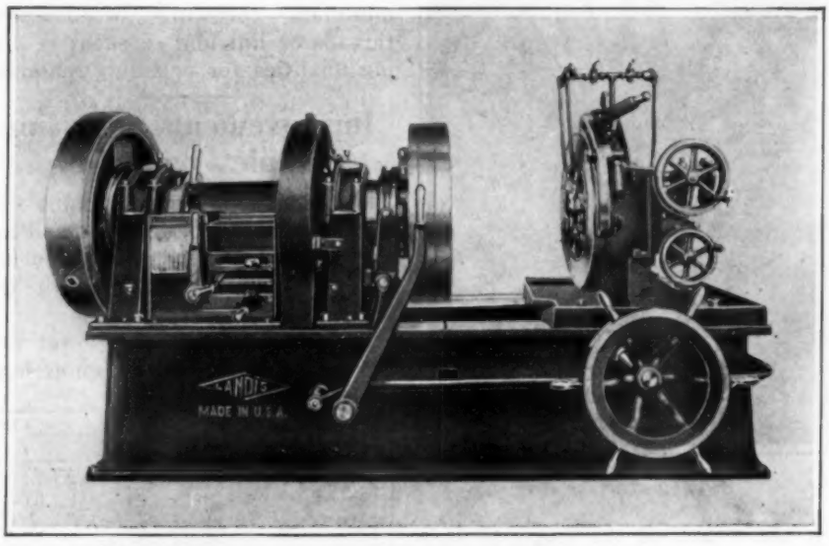
The company makes a specialty of supplying special jigs and fixtures for the machine to specification.

SHOP EQUIPMENT NEWS

Landis 6-In. Pipe Threading and Cutting Machine

The Landis Machine Co., Waynesboro, Pa., has added to its line of pipe threading and cutting machines one having a range from 1 to 6 in. inclusive. The machine is either belt or motor-driven. The photograph shows the operating side of a belt-driven machine, having a geared headstock and a single-pulley drive.

In the motor-driven machine the motor is mounted at the rear on a plate over the gear box. The power is transmitted by a chain. A 7½-hp. constant-speed motor turning at approximately 1,200 r.p.m. is required. The motor can be applied to the belt-driven machine when desired.



Landis 6-In. Pipe Threading and Cutting Machine

The travel of the carriage of this machine is 22 in. and it has eight speeds. The variations in speed are obtained by means of a self contained gear box, located beneath the main spindle. The gears run in an oil bath. The bushings are bronze. The shaft bearings are lubricated automatically by a forced-feed system. The main bearings are lubricated by flat-link chains which run in an oil container.

Two die heads are employed, the first for a range from 1 to 2 in., and the second from 2½ to 6 in. The entire range of each head is covered by but one set of chasers.

The front chuck has universal adjustment and is lever-operated. This permits of gripping and releasing the pipe while the chuck is in motion. A universal geared chuck is employed at the rear of the machine and is fitted with flange grips for screwing flanges on and off. Both chucks have three jaws. A reverse drive is obtained by a shifting lever for taking on and off flanges.

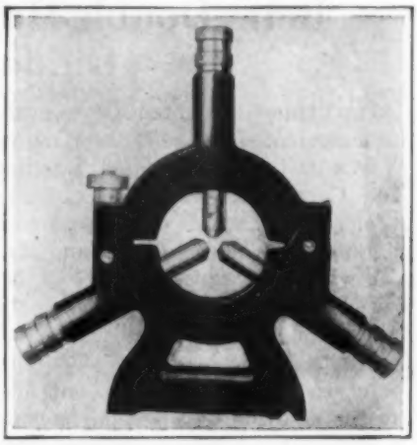
The cross-rail supports the die head and is also fitted with cutting-off tools, a reaming tool and a length gage. The die-lubricating system includes a rotary pump, a by-pass for the surplus oil and a special control valve at the head, and cutting-off tools.

The floor space occupied is 10x5 ft. The machine weighs 8,800 pounds.

Porter-Cable Mulliner Steadyrest

The Porter-Cable Machine Co., Syracuse, N. Y., has developed the steadyrest illustrated, and is building it for application to any 12- or 14-in. tool room lathe.

Its principal distinctive features consist in the design of the jaws and in the interchangeable jaw tips. The jaws are round, and are ground to size. A key holds them from turning. Adjustment is made, and position is set, by means of the knurled adjusting heads and lock nuts located on the outer ends of the jaws. The purpose of this design is to eliminate the wrench.



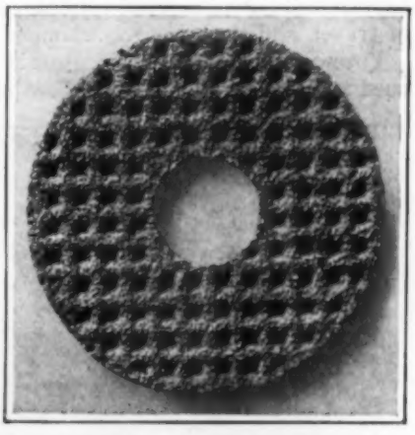
The Mulliner Steadyrest

The company is prepared to furnish the interchangeable tips of any special material specified, for insertion in the work end of the jaws.

Gardner Deep-Corrugated G. I. A. Disk

The accompanying illustration shows the face view of a grinding disk put on the market by the Gardner Machine Co., 410 E. Gardner St., Beloit, Wis.

It is especially designed for use upon work having large surfaces to grind. The surface of the disk is corrugated with holes extending practically through to the cloth backing. The purpose is to provide chip clearance and to prevent glazing the disk, thus decreasing the tendency of the work to heat up when being ground rapidly.



Gardner Deep-Corrugated G. I. A. Disk

SHOP EQUIPMENT NEWS

Betts Double-Housing Locomotive-Guide Planer

The planer illustrated has recently been completed by the Betts Machine Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y., for high-production planing on locomotive parts and similar work. Its capacity is 57 in. between housings, 31 in. under the cross-rails and 20 ft. in length between the table pockets.

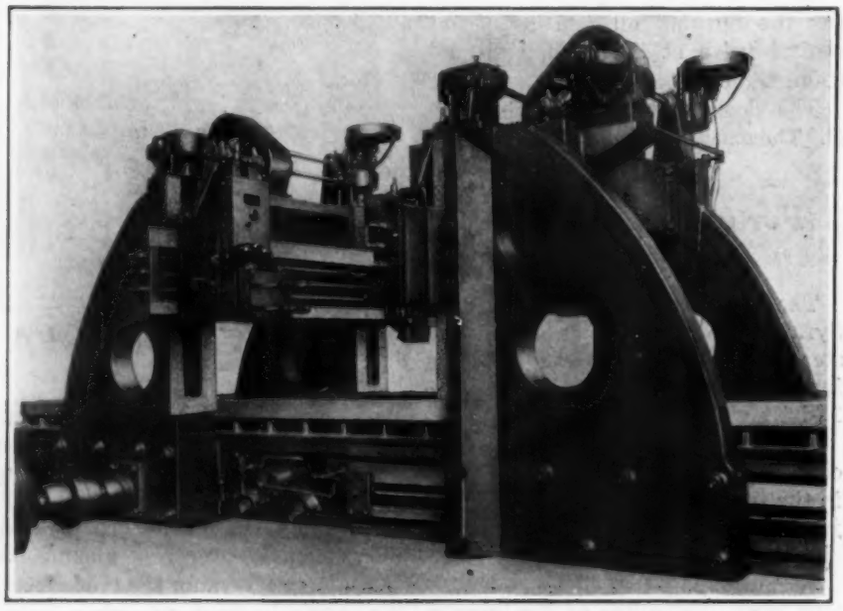
Increased production is obtained by the addition of a second housing to make use of the return stroke for useful cutting.

The planer bed, table, table-drive and the housing to the left, as shown, constitute a standard planer with the Betts Machine Works' features of design incorporated. Among these are the all-steel driving gears and rack; the electric head-feed, rapid power traverse, and cross-rail vertical adjustment, independently motor-actuated for each housing; the main-drive 250-500 r.p.m. reversing motor; and the rigid box-type table, gibbed to the bed for its full length.

The housing to the right carries duplicate equipment but is mounted on slides for adjustment by means of an independent motor-driven set of lead screws. Thus it can be set for any desired position, within its range of travel, and then securely clamped.

Forced and filtered lubrication is used at the essential points. Flow of oil is induced by two independent motor-driven oil pumps.

All motors are controlled through push buttons conveniently located.



Betts Double-Housing Locomotive-Guide Planer

Bias Centerless Buff

A buff is announced for the market by the Bias Buff & Wheel Co., Inc., 8 West 40th St., New York City.

This buff presents all of the threads

Bias Centerless Buff

in the weave of the material at a constant angle of nearly 45 deg. with a tangent to the outer edge. A complete wheel is built up of sections and secured by means of special flanges, which are furnished as required with the first buff.

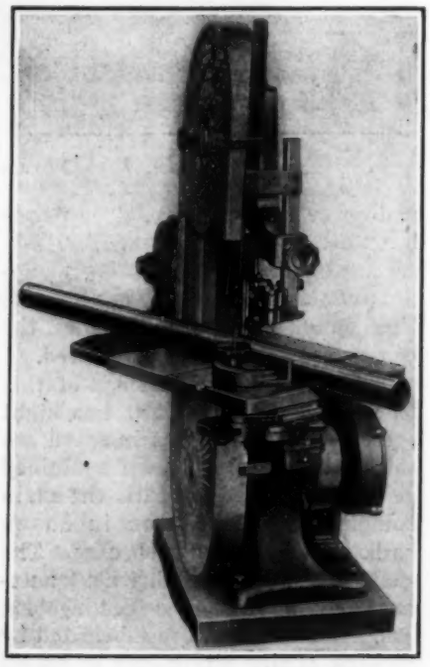
The material is cut on the bias in strips that are substantially the outer circumference of the buff in one dimension, and the distance from the outer edge of the buff to its inner edge in the other dimension. By sewing this strip into a ring and then gathering toward the center and sewing one edge of the ring, a buff section is produced as illustrated.

Exhaustive tests are said to show, among other things, high wearing qualities due to the constant angle of the thread to the circumference, a minimum throwing of loosened threads or lint and excellent retaining qualities for polishing material.

Improvements to Racine Duplex Band Saw

The Racine Tool & Machine Co., Racine, Wis., has redesigned and improved its duplex band saw and has put the model illustrated on the market.

The table and integral lower saw guide and the upper saw guide have



Racine Duplex Band Saw

been arranged to swivel about a common center in order to turn the blade and permit cutting long lengths of stock without interference with the upcoming side of the saw or the machine frame. The change-speed

SHOP EQUIPMENT NEWS

device which adapts the machine, previously described in *American Machinist*, Vol. 57, page 938, to cutting the harder metals, as well as wood, has been made a standard feature.

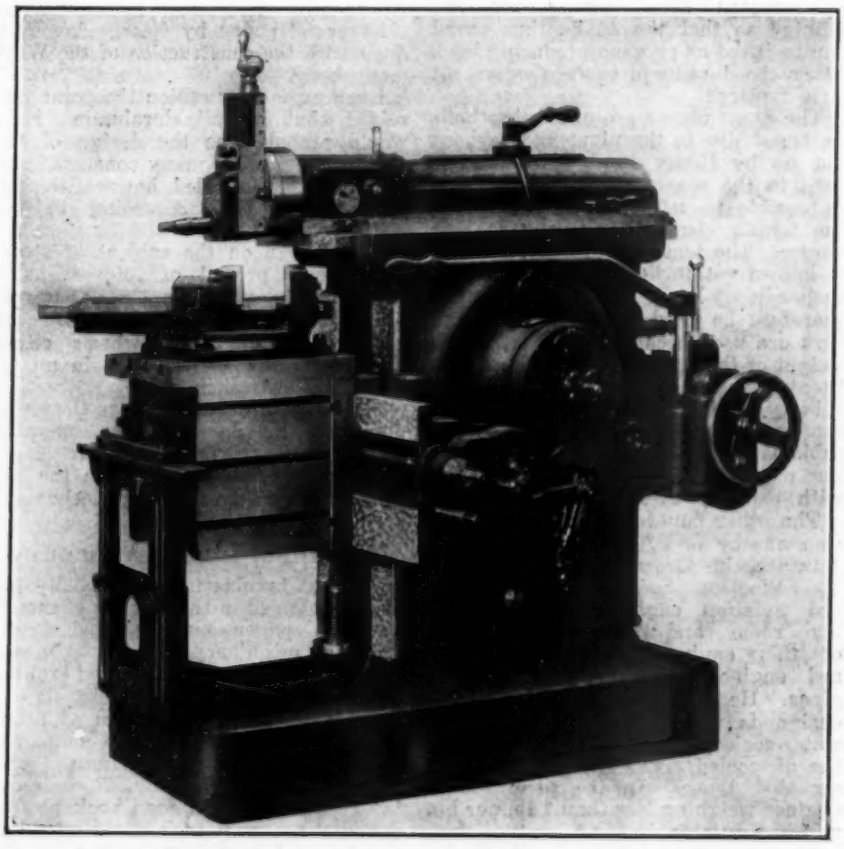
Horizontal, and blade-width and thickness adjustments are provided in the ball-bearing, hardened-roller guide that permits compensation for blade faults that usually cause crawling. Thumb screws and hand wheels eliminate the necessity of wrenches for these adjustments.

Stockbridge 16-In. Heavy-Duty Back-Geared Shaper

Another size has been added to its line of heavy-duty shapers by the Stockbridge Machine Co., Worcester, Mass., in the 16-in. back-geared machine, designed for heavy work in the tool room.

The features of construction that include the gear box drive, the automobile-type clutch and the rigid base, frame, and work table are essentially the same as previously described in the *American Machinist*, Vol. 60, page 787. An additional point in construction lies in the use of the clutch lever to actuate a brake, by throwing it beyond the "out" position where it also locks the machine against accidental starting. Among other points are the control handle for operating the feed in either direction without stopping, and the available automatic down-feed which can be used if desired.

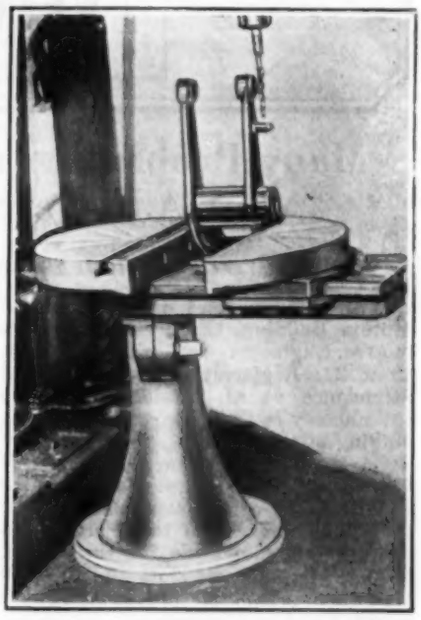
A rugged vise stands 4½ in. above the table and has jaws 12x2½ in. with a 12-in. range of action.



Stockbridge 16-In. Heavy-Duty Back-Geared Shaper

Pedestal for "Modern" Combination Drill Table and Vise

The Modern Machine Tool Co., 601 Water St., Jackson, Mich., has added a pedestal to its combination drill table and vise that was described on page 203, Vol. 58 of the *American Machinist*. The pedestal increases the adaptability of this piece of equipment.



Pedestal for "Modern" Combination Drill Table and Vise

It is substantially proportioned and can be used to support the drill table from the floor or from any conveniently located position within the swing of a radial drill as illustrated.

More Iron Buying in Italy

Imports of the leading iron and steel products into Italy during the first nine months of 1924 were running in heavy volume as compared with receipts for the corresponding period of 1923, Commercial Attache MacLean, Rome, reports to the Department of Commerce. The shipments from the United States showed large increases, particularly in bars, rods, and rough-finished plates. A fair amount of scrap also came from the United States as compared with relatively negligible imports in 1923 and 1922.

Shipments from the United States of finished plates (so designated in the official records, though they consist of almost 95 per cent tin plate) also showed an increase of over 30 per cent compared with 1923, but imports of these products from Great Britain amounted to almost four times the quantity brought from the United States.

The United States sold only 15 metric tons of pig iron to Italy of a total importation of 130,917 tons of that product during the first nine months of 1924. France and Great Britain were the sources of the bulk of the Italian imports of pig iron, other countries of origin being Spain, Sweden, Germany, and Austria.

News of the Week

Many Problems Are Discussed at the S.A.E. Detroit Meeting

The future of airplanes plays prominent part at sessions

With headquarters in the General Motors Building, the Society of Automotive Engineers met in Detroit, Jan. 19 to 22. Registration was heavy and attendance at all sessions was very satisfactory to those responsible for the staging of the affair.

On Monday afternoon the Standards Committee met and passed on about the usual number of recommendations. Of particular interest to the machine industry were standards for thread fits, gaging of castle-nut slots and tap-drill reference tables, all presented by the Screw-Threads Division.

At the adjourned session of the business meeting that took place on Tuesday evening, H. M. Crane, retiring president, commented on the healthy financial condition of the society and dwelt on the seriousness of the competition now facing the automobile industry. The long-deferred market saturation point seems finally to have been reached and a keen fight for supremacy is the natural consequence.

The new president, Harry L. Horning, in a brief address, stated that one of the cardinal points in his program would be a strenuous endeavor to reduce motor car accidents.

On Tuesday morning there was a general session devoted to research at which J. A. C. Warner, director of the research work of the society, read a paper describing the various types of instruments now available for all sorts of testing and investigation.

Exhibits for Testing

In the meeting room were perhaps a dozen of the various instruments mentioned at the conclusion of Mr. Warner's remarks. They were demonstrated and explained in their use.

The same interesting use of demonstration models was a feature of the address on "Measurment of Engine Vibratinn Phenomena," by C. E. Summers, General Motors Research Corporation, on Tuesday evening following the business meeting. The speaker had a rubber crankshaft to illustrate the way in which an actual shaft responds to stresses imposed on it. He also had apparatus to show the three critical vibration speeds that exist for each crankshaft.

Probably the most interesting paper of the meeting was that presented by W. B. Stout of the Stout Metal Airplane Co. on "The Design of All-Metal Airplanes," at the aviation session Tuesday afternoon. The speaker upheld the reputation of American aeronautical engineers by stating that almost all of the speed and endurance records have been held by American planes until the last week or so when new ones were set up by a foreign thick-wing monoplane. Our air mail service flies more miles than all of the European services put together and is the only one operating a day and night service on schedule.

Mr. Stout pointed out that an industry like commercial aviation must not expect to live on government subsidies but must make its own way by providing better transportation in a manner that will make it a financially profitable venture. His company is not interested in government contracts but is now constructing all-metal airplanes for intercity service and is doing everything possible to promote the establishment of regular intercity routes.

Saving on Weight

The essentially practical nature of the venture was brought out by the statement that every pound taken into the air costs seven cents per hour. For this reason Stout planes are not painted so that the 40 lb. thus saved can be lifted as revenue producing load. When the duralumin surface wears out it is replaced.

The Stout planes are now being built on metal jigs in the plant at Dearborn put up by Henry Ford. No wood is used in the construction because it is impossible to tell within 40 per cent the tensile strength of even the best spruce. The tensile strength of metals is known within 5 per cent and a correspondingly lower factor of safety can therefore be used. No tubular members are used because of the excessive weight of the tubular joint fittings. The Stout plane, powered with the same Liberty engine is 700 lb. lighter than the round-the-world cruisers. The cabin is made crash-proof and the flying characteristics have been secured with primary attention to safety.

The other paper at the aviation session was by L. M. Woolson on "Recent Advances in Aircraft Engine Design." Mr. Woolson had a 500-hp. Packard aviation engine in the assembly room and samples of parts of this engine, the 800-hp. Packard engine and other aircraft engines. He stated that aircraft engine design is in a fluid state with the water-cooled, 12-cylinder, V-type and the air-cooled, fixed radial as the two accepted types. In the near future engines weighing less than 1 lb. per hp. will be available.

The new Packard engine has also been built in inverted form with crankcase on top. The advantages of this construction are better visibility, higher center of thrust, greater accessibility to the mechanic working on the ground and the low position of the carburetor which permits the feeding of fuel by gravity and thus eliminates the complications of fuel pumps.

Mr. Woolson commented on the stunts now possible with modern planes that were undreamed of during the war, the reason for their feasibility being the fact that engine and plane together now weigh less than the engine alone of equal power a few years back.

Body Design

Two interesting sessions were devoted to the study of the design and construction of bodies. E. G. Budd, Philadelphia, delivered a paper that was a complete discussion of the problems of design and construction of all steel bodies. One of the big advantages of this method of construction is that the dimensions of the usual wooden pillar at the front of the body can be cut down to about ¼ of the area and so give the driver increased vision in a place where it is of vital importance, he stated. A series of motion pictures showed the operations and the jigs and fixtures used to secure accurate assembly.

A second paper by George W. Kerr dealt with the construction of the Weymann body.

During the discussuion the point was raised that an all duralumin body would probably be the design of the future. There are many constructional problems to be settled, however, before ultimate adoption, according to the speakers.

The papers on the subject of steering wheels proved of interest as a study of the vibration that occurs at high speeds such as 55 to 65 miles an hour, when the front wheels either vibrate rapidly sideways or in an alternating vertical motion.

F. F. Chandler, of the Ross Gear Co., described an hydraulically operated steering gear which measured accurately the forces set up in the various parts of the steering mechanism.

Machinery Makers' Incomes

The net taxable income of 322 companies engaged in the making of metalworking, paper making, and heavy ordnance machinery and in the manufacture of safes, vaults and rolling stock, was $63,813,469, in 1922, figures just compiled by the Bureau of Internal Revenue show. Of those companies 158 paid cash dividends during the year which aggregated $44,159,247, and with 126 companies which had book profits, but did not pay cash dividends, had surplus and undivided profits at the close of the year totaling $274,059,588.

Great Britain Increases Purchases of Machinery from United States

Nearly all branches are benefited by gains made in 1924

United States sales of machinery to Great Britain during the first nine months of 1924 amounted to more than $11,000,000, according to the Industrial Machinery Division of the Department of Commerce. The United States has supplied approximately one-third of the machinery imported by Great Britain since 1921, this in spite of the fact that German manufacturers during this period have had the advantages of the declining mark and other European countries have also had the benefits of falling exchange. Furthermore, British purchases of American machinery have shown consistent increases during each of these three years.

During the period since 1910, Great Britain has ranked from second to sixth among the various world markets as a purchaser of United States machinery. During 1923, Great Britain bought more than $14,517,000 worth of industrial machinery (excluding electrical and agricultural), and at that time ranked second among the various foreign markets. This large volume of machinery was about $10,000,000 more than the total absorbed by Great Britain in 1910.

In 1923, the United Kingdom absorbed about one-sixth of total American exports of metal-working machinery—$2,451,499 worth out of a total amounting to $13,104,586. The importance of Great Britain as a market for American machine tools is further shown by the fact that over half the metal-working machinery shipped to the whole of Europe in that year—$4,853,729 worth—was exported to the United Kingdom. United States customs figures for the first nine months of 1924 show an increase of more than 20 per cent in exports of metal-working machinery to Great Britain over those shipped to that market during corresponding months in 1923—from $1,842,470 to $2,268,954.

Lathes Show Gains

Exports of American lathes gained from $87,230 to $114,406 for the periods mentioned and shipments of planers, shapers, and slotters showed an increase of approximately 300 per cent. Exports of gear cutters, milling machines, and reamers, drills and other parts for machine tools showed decided gains. American exports of power hammers to Great Britain advanced more than 100 per cent during the nine months' period in 1924; pneumatic portable tools rose from $157,252 to $270,869; and foundry and molding equipment from $34,723 to $101,250.

Figures for the first nine months of 1924 indicate an advance of nearly 50 per cent in exports of textile, sewing and shoe machinery to Great Britain in comparison with corresponding months of 1923. Exports of American knitting machines increased from $584,369 to $1,066,455, reflecting a decided gain in the demand for this type of textile machinery in England. Wool carding and weaving machinery exports to this market increased nearly 100 per cent and exports of miscellaneous textile machinery (unclassified) advanced from $247,384 to $545,153. The United Kingdom absorbed factory sewing machines valued at $661,938 during the first nine months of 1923 and $809,792 worth during the corresponding months of 1924.

A summary of exports of industrial machinery from the United States to Great Britain shows a satisfactory increase of exports of power generating machinery in the first nine months of 1924 over the corresponding period in 1923. Construction and conveying machinery exports increased only slightly during the last period mentioned due principally to declines in purchases of hoists and derricks, conveying equipment, and elevators. These declines have been more than offset, however, by increased shipments of steam shovels, pile drivers, concrete mixers, and certain items of road making equipment.

Providence Meeting of N. M. T. B. A.

A regional meeting of the National Machine Tool Builders' Association was held at the Providence-Biltmore Hotel, Providence, R. I., on Jan. 20. The attendance was particularly good considering the heavy snow storm that raged all day. A good representative delegation came down from Worcester, while Rochester, N. Y., Springfield, Vt., Boston, Hartford, and Newark, N. J., were also represented. President Iles was in the chair and Ernest F. Du Brul gave interesting facts concerning the trend of industry, the comparative cost of labor and material and data as to expenses and profits, covering a period of years.

Questions of sales costs, sales methods and research of both a technical and business nature received close attention and many interesting phases were brought out and discussed. Among them was the question of used machinery and its effect on the industry.

The members and guests present were entertained at a very enjoyable luncheon provided by the Providence members.

Many Will Attend the Brussels Meeting

More than 2,500 leading business men in all parts of the United States have been invited to attend the third general meeting of the International Chamber of Commerce to be held in Brussels, June 21-27, at which important world trade problems will be discussed. Early responses to the invitations, signed by A. C. Bedford, chairman of the American Section of the International Chamber, indicate that an unusually large delegation of American business men will attend the Brussels meeting.

In the invitations sent out by Mr. Bedford, it is stated that "the business men of the United States have a direct and vital interest in the restoration of international commerce. If the views are to be properly and adequately presented in this most important conference it is essential that the delegation of the United States be a large and representative one.

"In addition to the opportunity of meeting, at the conference table, the leading business men of the great commercial nations of the world, the opportunity for a personal observation of European conditions is afforded those in attendance at this meeting, through specially arranged tours of Europe following the conference."

Chain and Sprocket Standardization

The American Society of Mechanical Engineers, the Society of Automotive Engineers and the American Gear Manufacturers Association have been designated as joint sponsors for the standardization of roller-transmission chains and sprockets. A sectional committee from these three organizations will carry on the work with the approval of the American Engineering Standards Committee.

For the past seven years members of the Chain Committee of the S.A.E. and the Roller Transmission Chain Committee of the A.S.M.E. have worked jointly on these standards. During this time there has been developed and published the following standard reports which are now very generally recognized by American industry: Roller-Transmission-Chain Dimensions, Heavy, Medium and Light Series; Roller-Transmission Chain Sprockets; Tooth Forms for Roller-Chain Sprockets and Corresponding Cutter Design; Uniform System for Numbering Chains; and Roller-Chain Nomenclature.

The work of the new sectional committee will include a review of the work on steel-roller chains and sprockets, a study of the possibility of standardizing certain elements of the so-called silent type of transmission chains and pinions, and the development of other standards in the field which may prove to be necessary.

All societies and associations having an interest in this project from the point of view of the manufacturer, distributor, or user will be asked to appoint official representatives to the sectional committee. Communications regarding the work should be addressed to C. B. LePage, assistant secretary of the A.S.M.E., 29 West 39th St., New York City.

Machine Screw Men Will Meet at New Haven

The first meeting of the New England Machine Screw Products Manufacturers' Association will be held Feb. 6 at the Union League Club, New Haven, Conn. The secretary of the association is Carl W. Bettcher of the Eastern Machine Screw Corporation, New Haven, Conn. This association is the Eastern division of the National association.

Personals

HENRY PEARLEY, sales manager of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has gone to Europe on a business trip.

JOHN B. CORNELL has resigned as treasurer of the Niles-Bement-Pond Co. and of the Pratt & Whitney Manufacturing Co., New York, after a connection of 25 years with these firms. He will in the future be affiliated with the Business Extension Service, Inc., New York City.

PHILIP O. GEIER, treasurer of the Cincinnati Milling Machine Co., Cincinnati, Ohio, has been elected president of the Cincinnati Chamber of Commerce.

DEANE S. HAZEN has resigned from the organization of the National Acme Co., Cleveland, Ohio, effective Feb. 1, and has accepted a partnership in the Shelley Co., Springfield, Mass.

A. H. D'ARCAMBAL, metallurgist of the Pratt & Whitney Manufacturing Co., Hartford, Conn., was the speaker at the recent meeting of the Hartford Chapter of the American Society for Steel Treating. There were 135 present. He spoke on the analysis, treatment and application of tool steels, explaining inspection methods by which quality steel is obtained.

A. C. WARN has been appointed assistant general manager of the Eclipse Interchangeable Counterbore Co. Detroit, Mich.

J. E. STOVER has been promoted to assistant sales manager of the Van Dorn & Dutton Co., Cleveland, Ohio. He was formerly employed in a sales engineering capacity.

U. D. THOMAS has resigned from the New York office of R. S. Stokvis & Sons, Inc., and has again become associated with Sidney G. Reilly. They have formed a new company called Trading Ventures, Inc., with offices at 25 Broadway, New York, and will deal in exports and imports from Czechoslovakia, Austria, Germany and the Baltic Provinces.

J. L. PRICE, formerly vice-president and treasurer of the Chicago Pneumatic Tool Co., is now vice-president and general manager of the newly organized Bendix Corporation, Chicago, and president and general manager of the Bendix Brake Co., South Bend, Ind., a subsidiary of the Bendix Corporation.

T. H. BELLING, formerly stationed at Indianapolis, has been transferred to the St. Louis, Mo., office of the Black & Decker Co., Towson, Md. His headquarters are at 2839 Locust St.

W. H. PUGH has been appointed representative for the Northwestern portion of Pennsylvania by the Roller-Smith Co., New York. His headquarters will be at Bethlehem, Pa.

JOHN F. STEVENS has been awarded the John Fritz Gold Medal by the Engineering Foundation for his work on the Panama Canal and for his general ability as a builder of railroads.

HOWARD A. ROGERS, Chicago representative of the Burt Machine Co., has moved from Machinery Hall to 1553 W. Madison St.

ARTHUR T. CLARAGE has been elected president of the Columbia Tool Steel Co., Chicago Heights, Ill. He succeeds A. R. WATERS who is retiring. Mr. Clarage is the son of the late E. T. Clarage who was the founder of the company.

C. WOOD WALTER recently celebrated his twenty-fifth anniversary with the Cincinnati Milling Machine Co., Cincinnati, Ohio. Mr. Walter is a graduate of the University of Wooster, Wooster, Ohio, and following his graduation became the assistant manager of the *Cincinnati Commercial Tribune*. Later he joined the organization of the

C. Wood Walter

Cincinnati Milling Machine Co. and at the present time is the vice-president and secretary. He has been prominent in the activities of the National Machine Tool Builders' Association and is one of its directors. He did excellent work on the Tariff Committee.

GEORGE M. EAMES, general manager of the Singer Manufacturing Co., Bridgeport, Conn., has been re-elected president of the Board of Park Commissioners of Bridgeport.

L. T. MILLER has been appointed purchasing agent of the Detroit Steel Products Co., Detroit, Mich. He succeeds T. F. THORNTON who recently resigned.

T. F. THORNTON has been made president of the Roehm Steel Rolling Mills, Detroit, Mich.

FRANK E. WITT has been appointed general sales manager of the Flint Motor Co., Flint, Mich. He succeeds T. S. JOHNSTON who has resigned.

L. COOPER SCHAUDIES and R. J. HIGGINBOTHEM have formed the La Grange Iron Works Co., at La Grange, Ga., taking over the foundry and machine shops of the J. T. Tice Co. on Morgan St., idle for some months. Additions and improvements to the shops are being made after which capacity production will be undertaken.

J. L. OSGOOD, of the J. L. Osgood Tool Co. of Buffalo, sailed Monday night, Jan. 19 at 10 o'clock on the S. S. *California*, on the first leg of a world tour. He will go first to Cuba, then through Panama to the West coast, the Orient, and Europe, expecting to return about July 1. He will spend three months in Europe, studying conditions relative to the machine tool market.

LEE H. BENSON has resigned his position with the Willys-Overland Co. to accept one as manufacturing engineer with the Westinghouse Electric & Manufacturing Co., in East Pittsburgh.

C. M. KRINER has left the Power Equipment Co., Boston, to accept a position with the Turbine Equipment Co., Boston.

WILLIAM RUDDY has returned to Detroit after 18 months in Paris where he was engaged in remodeling the factory of André Citroën and introducing American methods.

F. U. CONRAD, who has been chief engineer for the Underwood Computing Machine Co., New York City, has gone to Bridgeport where he is general superintendent of Plant No. 2 of the Underwood Typewriter Co.

R. T. HODGKINS, formerly vice-president of the Rollin Motors Co., Cleveland, has been appointed sales manager of the Rickenbacker Motor Co., Detroit, Mich.

FRANK L. KLINGENSMITH, who has been president of the Gray Motor Corporation since the spring of 1921, has severed his connection with the company. His successor has not thus far been announced.

GEORGE E. DOKE, engineer of materials and equipment of the New York Central R.R., has resigned effective Feb. 1 and has been elected president of the Association of Manufacturers of Chilled Car Wheels, succeeding George W. Lyndon, deceased. His headquarters will be in Chicago.

B. A. GRAMM, pioneer motor truck builder, and R. M. KINCAID, recently vice-president and general manager of the Garford Truck Co., Garford, Ohio, have organized Gramm & Kincaid Motors, Inc., of Lima, Ohio, for the manufacture of a complete line of motor trucks and buses.

RUSSELL HUFF, chief engineer of Dodge Bros. since 1915, now has the title of director of engineering. CLARENCE CARSON, formerly assistant chief engineer, has been appointed chief engineer. Mr. Huff is also a member of the board of directors of Dodge Bros.

T. S. MCEWAN has resigned from the Cowan Truck Co., Chicago, and has joined the Haynes Corporation Industrial Engineers, Chicago.

E. A. CALLANAN has been made sales manager of the Rollin Motors Co., Cleveland, Ohio.

L. CLAYTON HILL, formerly assistant general manager of the Society of Automotive Engineers, has joined the staff of the Valentine Co. in charge of sales in the Detroit district.

Business Items

The Norton Co., Worcester, Mass., has started work on the production of 37 precision grinding machines for the Nash Motor Co., for use at its plants in Milwaukee and Kenosha, Wis., and Racine, Mich. The Bethlehem Steel Co., Sparrows Point, Md.; the Carnegie Steel Co., Munhall, Pa., and the Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., have each placed an order for a giant roll grinder.

The Swind Machinery Co., Philadelphia, has opened a Baltimore office at 902 Standard Oil Building, Franklin St. and St. Paul place.

The Chapman Machine Co., at Terryville, Conn., organized about a year ago, has re-elected its officers. Six per cent dividends were paid. Machinery, radio parts and other mechanical devices are manufactured.

The Weston Electrical Instrument Co., Newark, N. J., has changed its name to the Weston Electrical Instrument Corporation.

The E. L. Essley Machinery Co., Chicago, Ill., has been appointed exclusive sales representative in the Chicago district by the Foster Machine Co., Elkhart, Ind.

The Burns Brass Foundry, of Battle Creek, Mich., has reorganized with Fred Flanders, of Coldwater, and Charles Follett, of Battle Creek, as the new partners of Lorin H. Skinner. The company plans to specialize in brass, aluminum and bronze castings, custom work for garages, and bushings.

The Trinidad Foundry & Machine Co. has been incorporated with a capitalization of $100,000. The incorporators are F. J. Radford and H. B. Doveton. The business will be located in Las Animas, Col.

A certificate of incorporation was filed at the office of the Secretary of State for the authorization of the Telometer Co., Inc., of Stamford, Conn., which is to engage in the manufacture of gages for measuring oil, gasoline and other liquids. The authorized capital is $100,000. Edwin K. Norton, Joan K. Norton and Ernest M. Lofgren, all of Stamford are the incorporators.

It is announced that a syndicate of leading Canadian financiers has purchased control of the Canadian Car & Foundry Co. Control of this enterprise has been held for some years by the American Car & Foundry Co. W. H. Woodin, president of the American Car & Foundry Co., retains his personal interest in the company and remains on the board of directors.

The Appliance Engineering Co., Denver, Col., has been incorporated with a capitalization of $50,000. The incorporators are H. E. Ralston, W. T. Eddy, C. W. Adams.

The T. H. Symington Co. has changed its name to the Symington Co., Baltimore and Rochester.

The Moline Implement Co., Moline, Ill., has been incorporated with a capital of 30,000 shares of no par common stock, and has purchased from the Moline Plow Co. the latter's plow factory, assets and goodwill. The new corporation starts operation with assets of about $3,000,000, and with practically no indebtedness.

Fire destroyed the equipment of a three-story brick building occupied by Moynahan & Duchene, Inc., manufacturers of iron, brass and bronze fittings in Detroit. Officials estimate the loss at not less than $30,000.

Combined Southern offices have been opened in the Woodside Building at Greenville, S. C., by the Woonsocket Machine & Press Co., Inc., the Fales & Jenks Machine Co. and the Easton & Burnham Machine Co., with Edward Howard in charge as Southern agent, and William Lee in charge of the sales end of the business in the territory. These companies are manufacturers of textile machinery and equipment. Their Southern headquarters formerly were located at Charlotte, N. C.

The Queen City Steel Treating Co. and the Metallurgical Service Co., both of Cincinnati, Ohio, have combined and henceforth will be known as the Queen City Steel Treating Co.

The Hood Foundry Works, a new company formed recently with $100,000 capital at Charlotte, N. C., is planning establishment of a foundry and shops there this year, it has been announced. Officials named are W. M. Hood, of Charlotte; T. L. Talbert, Jr., and others, address of Mr. Talbert being given as 1708 Euclid Ave., Charlotte.

Obituaries

GLENN GRENVILLE HOWE, for many years senior vice-president of the Link-Belt Co., Chicago, died Dec. 25 at his home in Muskegon, Mich. He had been ill for some time. Mr. Howe started with the Link-Belt Co. when he was 16 years of age and later was the superintendent of the Ewart Manufacturing Co. In 1906 the Ewart Manufacturing Co. was merged with the Link-Belt Co. and Mr. Howe became vice-president in charge of the Indianapolis plant. He formed the Howe Chain Co. at Muskegon later and this was sold to the Link-Belt Co. in 1924.

EDWIN J. PEIRCE, JR., died recently in the Homeopathic Hospital, Providence, R. I. Mr. Peirce was 73 years of age and had been ill for some time. He was formerly vice-president and general manager of the Taft-Peirce Manufacturing Co., Woonsocket, R. I. and had been connected with various machine tool companies for the greater part of his life. He started in the business as a draftsman with the Brown & Sharpe Manufacturing Co., Providence, R. I. Later he was connected with the Hautin Sewing Machine Co., the Wardwell Co., and the Taft-Peirce Manufacturing Co. He retired from this company in 1907 and since that time has been a consulting engineer.

CARLTON W. LUCE, aged 71 years, general superintendent of the Detroit and Mackinac Railroad, died at his home in East Tawas, Mich.

WASHINGTON KIDWELL SHEPARD, for a number of years with the Atlantic Steel Co., of Atlanta, as a master mechanic, and well known in the Southeast in metal trades circles, died at a private sanitarium in Atlanta recently at the age of 76 years after a long period of illness.

WILLIAM G. MILLS, for the past 14 years in charge of the Southern territory as district manager of the Atlanta office for the National Carbon Co., of New York and Cleveland, died in Atlanta recently at the age of 51 years.

MERRILL W. WILCOX died recently at his home in Saginaw, Mich. He was the secretary and assistant general manager of the Wilcox Motor Parts & Manufacturing Co., Saginaw, Mich.

GEORGE A. GUTLIPH, chief engineer of the Crouse-Hinds Co., Syracuse, N. Y., died recently in that city.

CHARLES HULL CLARK, aged 93 years, one of the founders of the Clark Brothers' Bolt Co., died at his home in Southington, Conn. recently. He was president of the company, also head of the Southington Bank & Trust Co., and the Waterbury-Milldale Tramway Co.

Railroad Equipment Buying

Outside of the $4,300,000 rail order of the Pennsylvania System, purchases by railroads last week included one locomotive for domestic use, three for export and forty-two freight cars and twenty-nine passenger cars. The Chicago, West Pullman & Southern ordered one switch engine from the Baldwin Locomotive Works. The same company received an order for three Pacific type locomotives from Brazil.

The Standard Steel Car Co. received orders for thirty caboose cars from the Ford Motor Co., twelve gondola cars from the Carnegie Steel Co. and twenty-nine multiple unit passenger car bodies from the New York Central.

Inquiries for ten eight-wheel switching engines by the Chicago, Rock Island & Pacific, three Pacific type engines by the New York Central for the Rutland, 1,200 box cars and 400 gondolas by the Rock Island and thirty-five gondola cars by the National Plate Glass Co. also were reported. The Missouri Pacific will receive bids for repairs on 250 wooden cars and 2,250 wooden gondola cars.

Trbojevich Sells Gear and Hob Rights

The gear cutting methods described by Nikola Trbojevich in the *American Machinist*, Nov. 1, 1923, and commonly known as the "Terbo" gear, attracted considerable attention among gear makers and users. It is of general interest to note that the patents of this complete development have been purchased by the Gleason Works, Rochester, N. Y. The Gleason Works, however, granted back to Mr. Trbojevich an exclusive license under his hob patent only, to make, use and sell hobs, but only for cutting cylindrical blanks.

This license for making and selling hobs for cutting cylindrical blanks has been transferred to the Union Twist Drill Co. which is preparing to put them on the market.

The Business Barometer

This week's outlet in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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DURING the first half of last week the markets were relatively quiet and those who had liquidated their speculative holdings were boasting of their acumen. But on Thursday wheat, corn and most other cereals went through their previous tops and the stock market started up again.

But secondary bull movements are not as a rule aggressive and the recovery on the Stock Exchange was not very impressive. Its duration is anybody's guess, for the advance in grain, which really inspired it, has gone so far that it has become an element of danger rather than an evidence of prosperity.

With cash wheat at $2.00 in Chicago and corn at $1.35 it has of course been necessary to advance the cost of flour and bread and as high priced corn means high priced hogs, pork is dearer, together with cattle and beef. There is, in fact, every reason to expect a great scarcity of animal food next year as no farmer in his senses would dare to use corn that can now be sold at $1.35 to fatten live stock that cannot be marketed before the coming harvest when grain will probably be much lower than it is today.

The result is more or less maladjustment. It must be apparent to everyone, but there are not many who have the courage to call attention to it. One of these few is the National Bank of Commerce in New York, who points out that "consumers of goods are resisting higher prices" with the result that the "dangerous boom psychology has been corrected."

Leather and hides are moving rather more freely; just why is not entirely clear, but the shoe industry is better and it may be that the prospective shortage of cattle is a factor.

The experts seem to agree that the metal industries are on an even keel. Copper is a shade lower and the steel mills are working at about 85 per cent of capacity with orders coming in a little less freely than before New Years.

The railroads seem to have finished buying new equipment for the present and they announce that when what they have bought is delivered they will be able to handle a largely increased traffic with promptitude. The Department of Agiculture announces that "a series of reports on the economic outlook for the leading crops and live stock produced in the United States this year will be issued Feb. 2, 4 and 6." The purpose is "to give the farmers a comprehensive view of the general agricultural outlook." If these reports are anything like the cotton reports issued last year their effect upon business will be paralyzing and it is to be regretted that the government should rush in where angels fear to tread. Its findings are mistakenly regarded as so authoritative that the errors it will certainly make are sure to cost the country dearly.

What's Doing in Industry

Inquiries rather than orders were the reports received from machinery and machine tool centers throughout the United States and Canada last week. Gains for the month, however, are conceded and if the inquiries sent out result in orders in February, dealers will enjoy another month of good business.

The improvement in business has not been uniform during January. New England, for instance, reports an increase of 18 per cent over January, 1924, while Buffalo claims that business has been no better than for the last quarter of the year. Milwaukee, on the other hand, has been booming, according to reports, this due partially to the activity in the agricultural machinery factories in that district. Production in the Cincinnati district has been good, but nothing unwarranted.

Figures issued by the Government show that automotive production during the past year was 3,637,078 automobiles and trucks. Indications from the Detroit district are that this figure will be equaled this year, although there are many who doubt it. January figures have been high, but it is pointed out that the test comes with the months of May, June and July, when drastic cuts in schedules mean decreased totals.

The railroads are buying sparingly, according to dealers and, while lists have been issued, they have contained nothing other than ordinary purchases of necessities. This is no cause of worriment as the railroads can be depended upon to consume a good proportion of the machine tools manufactured.

The outlook abroad continues to improve. Sterling has touched 4.80 and England's return to a gold basis now seems assured. Gold is going out in large quantities. Exports for January will probably reach $50,000,000. But the shipments thus far made are apparently being taken from some concealed supply for the holdings of the Federal Reserve Banks are not much depleted. Last week these holdings were reduced by only $8,000,000 and the reserve ratio stands at 78.8 per cent as compared with 76 per cent at the end of the previous week. Earning assets decreased by $136,000,000 and circulation and deposits by an aggregate of $153,500,000.

These changes are interpreted to mean easier money, but as of Jan. 14 the loans and investments of the reporting member banks were at a new high record. They totaled $18,679,000,000 which was $336,000,000 in excess of deposits, amounting to $18,343,000,000.

The fact that the Federal Reserve Bank of New York earned only about 2.05 per cent on its capital of $30,000,000 in 1924 has been widely commented on. But it is not really important as it has a surplus of nearly $59,000,000 and the Federal Reserve Banks were not organized for profit.

A number of new though relatively small foreign loans are under consideration by bankers. Some of them will undoubtedly be brought out. What is called the export of capital is therefore likely to continue until interest rates are about equal in London and New York, the world's two great money markets. As money is now dearer in London than in New York a gradual advance here would seem to be logical, but it may be postponed until the next harvest season approaches unless the trade revival that the stock market has discounted develops. That revival is thus far a hope rather than a fact and it is possible that it may also be deferred until another year of good crops and good prices is assured.

Such a happy conjunction would be almost sure to produce great speculative elation in this country, but failing it we will probably have to content ourselves with the restrained prosperity that we are now enjoying.

The word "restrained" is used advisedly for even an optimist cannot shut his eyes to the increase of unemployment in our larger cities.

In the cities where the larger automobile factories are located it is the same story, and a press dispatch from Schenectady, N. Y., says that a committee investigating the unemployment there reports that it has found that thousands of men have been out of work for weeks.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

The volume of business for export delivery placed in sections of the New England territory during the past week or ten days is the basis of encouragement prevailing among the big machinery manufacturers. The countries that have bought well are England, Russia and Germany, with scattered buying for Austria, Italy and Japan. The buying for Japan was of substantial volume. Peru and other South American countries are represented in the prospective business to a marked degree.

The buying for Russia is judged to be for replacements, rather than for new developments. The nature of the buying in England, Germany and Japan is viewed to be of expansion character.

Signs of good business are found in Hartford, Waterbury and Bridgeport and these give the present business condition a somewhat spotty appearance. The spurts of sales are largely for domestic deliveries and where these have reported they have been coupled with statements of increases of working forces to meet the improved condition.

Sales managers consulted are in accord that the percentage of business resulting from inquiries is running ahead of a year ago. A sales manager who measures business placed with the volume represented in inquiries for the same period says that so far this year the business is 18 per cent better than for the corresponding period a year ago.

In the Hartford district it was stated at the manufacturers' headquarters that the machinery trade shows a better percentage of improvement in employment than appears in the textile trades.

Chicago

Very little change is noted in the Chicago machine tool market for the past several days, conditions seemingly remaining practically as they have been since the first of the year. This, however, does not imply that any doubt is entertained by dealers that the forecasts of greatly improved business are unlikely to be fulfilled. It means, simply, that industry and production have not yet started to speed up, and that until manufacturing plants are given the impetus confidently expected by a decided revival of trade in general, they will not be in the market for machine tools or special machinery to any considerable extent.

If future business may be gaged by inquiries, it will not fall short of expectations, these continuing to be received in satisfactory volume, and including both new and used equipment.

Within the last week there has been offered for sale an assortment of used machine tools and machinery that includes such items as automatic and hand screw machines, multiple spindles, engine lathes, bench lathes, milling machines, drills of various kinds, riveting, gear cutting and bobbing machines, grinding and polishing machines, and other machine tools and several lots of special machinery, together with a variety of tools, jigs and dies. These were the property of the United Manufacturing & Distributing Co. and are now in the hands of receivers, who are advertising for bids, that will be received until Jan. 31. They were used by the defendant company in the manufacture of phonograph motors, air cleaners, automobile equipment, transformers and condensers.

Milwaukee

The month of January probably will not pass into history as one of record breaking sales of metalworking equipment, but there scarcely has been a period in the past five years that witnessed so genuine a revival of activity with reference to inquiry. Moreover, the month now coming to an end is confidently regarded as the threshold entering upon a new era of active business in the foundry and machine shop industries.

For the present, comment on the situation necessarily must be in generalities, for the finger cannot be pointed in any one direction to index the sources of new business coming out or in immediate prospect. So far as prospects are concerned, however, the most promising individual industry seems to be the farm implement and equipment trade. This industry at the moment is employing more men and producing more goods than it has since the fall of 1920.

Advance orders for spring and summer delivery are without doubt the best since that time, while inquiry for prompt and deferred shipment is suggesting a briskness not known in a long time. Inasmuch as Milwaukee and the Wisconsin territory are among the most important implement production centers in this country, it is reasonable to assume that the healthy improvement in trade now becoming recognized augurs well for the makers of and dealers in the tools with which goods are made and built.

As a whole, the demand for heavy machinery is behind that for light equipment of all kinds. For example, in excavating machinery, the small, easily transportable types have a good call, while the massive designs for large projects have a poor market, but improving prospects. In prime movers there is some activity, hydro-electric generating units leading. Few important orders for large pumping units for municipal water works are in immediate prospect, but a number of these may develop before the close of the year.

Makers of machine tools still have to look to the automobile industry for the best field for sales. The Ajax plant equipment project of the Nash interests at Racine remains the most prolific of new business. Established concerns have been resting on their oars, so to speak, pending an exact appraisal of future requirements according to the sentiment developed by the national, state and local motor exposition season. Locally, the annual show held from Jan. 17 to 24 spoke well for a good absorption of passenger car output this year. The demand for heavy-duty vehicles for both passenger and freight transportation is believed to be only on the approach to its peak.

Comment in all quarters of the metalworking equipment industry and trade is of the most hopeful and optimistic order that has been discernable in at least four years' time and it appears that there is ample substance for it.

New York

Inquiries were plentiful during the past week, but orders were not up to the first weeks of the month in the New York district. Machinery and machine tools sold to considerable extent with every indication that business in February will be good, but dealers noticed the slight "let-down" from the pace set during the first fifteen days of the year.

The Lehigh Valley now has a list of tool requirements out as well as the Southern R.R. and the Delaware & Hudson. Usual small buying was recorded from the New York Central and from the Pennsylvania.

Automobile plants are preparing to buy, according to rumor, and it has been stated that one factory has sent out lists to a few of the New York dealers. Automobile accessory makers have been buying to some extent during the past month and radio receiving-set builders have also been in the market for single tools.

Much attention is being given to exports lately with the result that machine tools have been moving from Eastern and Western ports. Japan is again in the market for machine tools and manufacturers are watching carefully for either Japanese government buying or buying on the part of Japanese electrical companies.

Most exporters express the belief that while last year was good and no

losses were suffered, the next twelve months will bring in a great deal of new business and profits should be liberal.

The used machine tool market has been on a steady basis since the first of the year with little improvement expected for at least another month. Business is fairly good, but by no means record breaking.

Buffalo

Inquiries show considerable improvement since the first of the year and orders show a slight improvement. The feeling of the trade continues to be optimistic; more so in fact than at any previous time in more than eighteen months.

A few individual sales have been made of lathes, drills, grinders and presses. Perhaps the most important tendency noted during the last few days is the fact that a large number of small manufacturers are making inquiries for one or more pieces of equipment.

Two important lists have been reported out but it was stated authoritatively at the time this was written that they are still pending and will probably not be out much before Feb. 1.

The demand for road equipment, particularly for snow removal purposes, still continues to be strong and one of the companies in the local field claims that its chief difficulty is in obtaining the equipment fast enough to satisfy the demand.

New Winter Record for Car Loading

All previous records for this season of the year in the number of cars loaded with revenue freight were broken during the week which ended on Jan. 10, according to tabulations made by the Car Service Division of the American Railway Association of reports filed by the carriers with that organization.

The total for the week was 932,807 cars. This figure has never been reached before at this season of the year, the nearest approach being in 1924 when it was reached the middle of February, while in 1923 it was not reached until the last of March. Prior to that time, that figure has not been reached until about the middle of the summer.

Increase Shown

Compared with the corresponding week in 1924, the total for the week of Jan. 10 was an increase of 60,784 cars while it also was an increase of 59,899 cars over the corresponding week in 1923.

Due to increases in the loading of all commodities, particularly miscellaneous freight, merchandise and less than carload lot freight, coal and forest products, the total for the week of January 10 was an increase of 167,080 cars over the preceding week which included a holiday, New Year's Day.

The railroads also report the purchasing of additional equipment to take care of increased business that is anticipated.

Employment Representation Plan Shows Remarkable Growth

Conference Board reports rapid strides in workers' councils

Over 800 works councils or employee representation plans, covering more than a million workmen, are today in operation in the United States, says the National Industrial Conference Board, 247 Park Avenue, New York City. This has resulted from a practically continuous and rapid increase since 1917. During the last five years the number of councils rose from 225 in 1919 to 725 in 1922 and 814 in 1924 and the membership from 391,000 in 1919 to 690,000 in 1922 and to 1,177,000 in 1924.

Massachusetts leads in the number of works councils within her borders, increasing from 11 in 1919 to 31 in 1922 and to 105 in 1924. Other states having more than 10 councils in 1924 are New York, with 60; Washington, 45; Illinois, 39; Ohio, 30; Pennsylvania, 29; Connecticut, 28; California, 27; New Jersey, 19; Maryland, 18; Minnesota, 13; and Wisconsin, 11.

Considered by industries, the metal trades account for almost exactly one third of all the works councils; lumber for about one-fifth; and the printing trades for about one-seventh. A conspicuously large decrease since 1922 in mining is due to the ending by the Federal government of its insistence on works councils during the functioning of the Fuel Administration. Another large decrease, in lumber, is due to the amalgamation or cessation of work by many of the employee associations when the Loyal Legion of Loggers and Lumbermen was organized.

Nearly two-thirds of the 1,177,000 employees who are governed by works council plans are grouped in eleven industrial establishments employing 15,000 or more persons, and more than one-tenth more are in nine establishments employing from 10,000 to 15,000. On the other hand works councils in establishments employing less than 200 men are comparatively few. This seems to be because the contact between employer and employee in small establishments makes councils unnecessary, and because the operations of large plants, which are apt to be scattered, makes the contact between employer and employee slight and the councils valuable.

Thirty-five employers who once operated about 50 works councils, now discontinued, ascribe the breaking up of one-third of them to the business depression of 1920-1921, which so reduced the number of employees as to make the council of little use; of another third to lack of interest due to various causes, among which was that the close relations between employer and employees made them really unnecessary; and the other third, about one-half to friction and the rest to several minor causes.

Government Reports 1924 Auto Output

The Department of Commerce announces the total production of American-made motor vehicles for 1924, with separate totals for the last nine months for those made in the United States and for those manufactured or assembled in Canada. The 1924 total of 3,261,682 passenger cars and 375,396 trucks in both the United States and Canada are not strictly comparable with the totals for the two previous years, since not all the Canadian production was formerly included in the grand total; the totals for 1924 comparable with prior years are 3,202,059 passenger cars and 362,037 trucks, comparing with 3,637,216 passenger cars and 376,444 trucks in 1923. It is anticipated that segregated statistics for the production in the United States and in Canada for the first three months of 1924 can be published at an early date.

Sales Agents Appointed By Two Companies

The Meldrum-Gabrielson Corporation, Syracuse, N. Y., has appointed the following agents:

Russell, Holbrook & Henderson, New York City; Crane-Shiefer-Owens, Buffalo; the Stoer Machinery Co., Philadelphia; the F. H. McArdle Equipment Co., New Orleans; the J. S. Miller Machinery Co., Pittsburgh; the D. C. Slusser Sales Co., Detroit; Neff, Kohlbusch & Bissell, Chicago; the Northern Machinery Co., Minneapolis; and Arthur Jackson, Toronto, Canada.

The Morgan Engineering Co., Alliance, Ohio, has appointed the following agents:

C. O. Cromwell, Detroit; F. E. Bausch, St. Louis; Duncan A. MacLeod, Buffalo; R. R. Glover, Cincinnati; W. R. McDonough & Co., Cleveland; the McMullen Machinery Co., Grand Rapids, Mich.; the Millholland Sales & Engineering Co., Birmingham, Ala.; the P. I. Perkins Co., Boston; Stewart H. Ford, Richmond, Va.; and the Dravo-Doyle Co., Philadelphia, Pa.

Good Business Outlook for Mergenthaler

There is every indication that the business for 1925 will exceed that of 1924, according to a statement made by Philip T. Dodge, president of the Mergenthaler Linotype Co., New York. In Europe much depends on the restoration of normal exchange between the countries, he stated. In Germany, as a result largely of the operation of the Dawes Plan, his company is operating on a gold basis and with a much larger production than before the war, while in the English plant, that produces all classes of printing machinery, the business is steadily improving. The British products are largely exported to continental countries.

Successful Exhibit at Birmingham

The Young & Vann Supply Co., Birmingham, Ala., was the sponsor for a machine tool exhibit held Jan. 12 to 24. The attendance at the show was much greater than was expected and while no accurate check is possible, indications point to many sales.

Invitations were sent to all of Birmingham's manufacturing, mining and industrial corporations and a number of mechanical and railroad shop managers also attended the exhibition.

Exhibitors at the show were: American Tool Works Co., Cincinnati; Barnes Drill Co., Rockford, Ill.; Brown & Sharpe Manufacturing Co., Providence, R. I.; Chisolm-Moore Manufacturing Co., Cleveland; Cincinnati Electrical Tool Co., Cincinnati; Cleveland Twist Drill Co., Cleveland; Colonial Steel Co., Pittsburgh; Jewel Belting Co., Hartford, Conn.; Kearney & Trecker Corporation, Milwaukee; Norton Co., Worcester, Mass.; Skinner Chuck Co., New Britain, Conn.; Smith's Inventions, Inc., Minneapolis, Minn.; Henry G. Thompson & Son Co., New Haven, Conn.; Warner & Swasey Co., Cleveland.

Bell Laboratories Formed

The growth of the research and development work of the Bell System has led to the formation of Bell Telephone Laboratories, Inc., organized on Jan. 1, 1925, for the purpose of carrying on development and research activities in the communication and allied fields.

This new company, which is jointly owned by the American Telephone & Telegraph Co. and the Western Electric Co., Inc., has taken over the personnel, buildings and equipment of the research laboratories of these two companies which were formerly operated as the Engineering Department of the Western Electric Co.

Extensions of laboratory facilities for the scientists and engineers of the new corporation are already under way. Laboratory space in the form of a new building covering almost a quarter of a city block will be added to the 400,000 sq.ft. at present in service in the group of buildings at 463 West St., New York City. At the date of incorporation, the personnel numbered approximately 3,600, of whom about 2,000 are members of the technical staff, made up of engineers, physicists, chemists, metallurgists and experts in various fields of technical endeavor.

Seasonal Advance in Cost of Living

Average prices of three of the major items comprising the total cost of living increased slightly between Nov. 15 and Dec. 15, 1924, according to the monthly survey by the National Industrial Conference Board. These increases were 1.3 per cent for food, six-tenths of one per cent for fuel and three-tenths of one per cent for clothing. Seasonal influences probably contributed to these advances. The average cost of the other items included in the total cost of living remained unchanged. The total increase for all items combined during the month was five-tenths of one per cent.

Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and December, 1924, the cost of living decreased 18.8 per cent.

Spare Heads Philadelphia Foundrymen's Association

At the recent meeting of the Philadelphia Foundrymen's Association held at the Manufacturers Club, the following officers were elected for the coming year:

C. R. Spare, president; C. F. Hopkins, vice-president; W. G. Summers, treasurer and Howard Evans, secretary. No change was made in the executive committee, but R. E. Blaigo was elected to the membership committee succeeding Mr. Hopkins, the newly elected vice-president.

Trade Catalogs

Hydraulic Pumps. The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. Hydraulic pumps for high pressure purposes are described in catalog No. 44. The publication contains much interesting data and information regarding pumps and is so presented as to be easily read and understood. The company makes several types of hydraulic pumps and these are described together with specifications for using.

Polyphase Motors. The Century Electric Co., St. Louis, Mo. A four-page folder has been issued by this company in which is set forth the merits of the polyphase squirrel cage induction motor. Illustrations show various important parts of the motor and well-written text describes the uses and economies of the product.

Portable Electric Tools. The Black & Decker Manufacturing Co., Towson, Md. Catalog No. 8 has been recently issued by this company and in it are presented many descriptions of the line of portable electric tools. Attachments and extra equipment are also listed and briefly described. Then, also the lines made by the company consisting of machine screws, nuts, studs and small tools are included.

Electrical Resistor. The Monitor Controller Co., Baltimore, Md. Bulletin No. 67 describes the Monitor Edgewound Resistor that is built to be used with motor starters and speed controllers. It is also adapted to all classes of service requiring an electrical resistor for relatively heavy currents. It is stated that it is moisture-proof, acid-resisting, unbreakable and requires less space than some other resistors.

Parallel Gages. The O. B. Herith Manufacturing Co., 272 Tolland St., East Hartford, Conn. The Herith adjustable parallel gages that may be used independently or in combination with the regular size block systems are described in this four-page folder. It is claimed that the gages are useful in setting sine bars, height gages and buttons, gaging slots, snap gages and other types. Four illustrations show the work for which the gages are adapted.

Lubricator. The Malcolm H. Smith Co., 50 Congress St., Boston, Mass. The Knorr lubricator adaptable to many machines for various uses is described in a new catalog recently issued. The lubricator is shown as attached to machines in prominent plants throughout the country and its merits are forcibly pointed out.

Pure Nickel Products. The Berndorf Metal Works, Berndorf, Lower Austria. Interesting four-page folders describing the nickel ware and fittings made by this Austrian company have been mailed out by Ernst Koeppen, 456 Fourth Ave., New York City, the agent for the company in this country.

Tapping Machine. Purinton & Smith, Hartford, Conn. The Hart & Hegeman High-Speed Automatic tapping machine that is sold through Purinton & Smith, is described in a four-page folder. There are several illustrations showing the machine at work and also showing close-up views of different parts of the machine. Its method of operation and simplicity are told in the accompanying text.

Power Presses. The Niagara Machine & Tool Works, Buffalo, N. Y. Various presses made by this company are described in this folder. The arch press, the trimming press, the inclinable press, double crank press and the squaring shears are all briefly described and illustrated.

Steel Products. The Moltrup Steel Products Co., Beaver Falls, Pa. The steel products of this company are described in a catalog just published. Cold drawn steel, turned and polished steel, machine keys, machine racks and flattened steel plates are gone into and intelligently described. Illustrations show shapes made by this company and diagrams show diametral pitch of finished machine steel rack. Tables and charts are included in the book.

Rodograph. The Bridgeport Brass Co., Bridgeport, Conn., has issued under the name of Bridgeport Ledrite Rod-O-Graph a chart from which may be calculated the gross weight of any number of pieces to be cut from rods. The shapes may be round, hexagon, octagon or square. A table of decimal equivalents accompanies the chart, being printed on the same page. The sheet is of cardboard and is 9¼x19½. A brass eyelet for hanging is provided. Copies may be obtaned upon request.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Buffing machine, hand or power, for use on composition slabs. Dublin, Ireland. Purchase. Reference No. 12,973.

Engines, oil, Diesel or semi-Diesel, including parts. Alexandria, Egypt. Purchase. Reference No. 12,969.

Engines, internal combustion, and other industrial engines. Sofia, Bulgaria. Purchase. Reference No. 13,008.

Oil engines. Rangoon, India. Purchase. Reference No. 13,007.

Machine tools. Paris, France. Agency. Reference No. 12,963.

Machine tools. Marseilles, France. Agency. Reference No. 13,010.

Machine tools and engineering small tools. Paris, France. Agency. Reference No. 12,967.

Machinery accessories. Naples, Italy. Agency. Reference No. 12,957.

Industrial machinery. Varese, Italy. Agency. Reference No. 12,955.

Metal working and wood working machinery and tools. Lausanne, Switzerland. Purchase and agency. Reference No. 12,961.

Forthcoming Meetings

American Management Association. Annual Convention. Hotel Astor, New York City, Jan. 28, 29 and 30. Headquarters, 20 Vesey St., New York City.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19 C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Steel prices have changed little during the past week. Bars represent the strongest item on the list of heavy rolled products. Plates and shapes are selling at $2@$2.10 per 100 lb., f.o.b. Pittsburgh mill; nothing under $2.10 is being quoted on bars. Demand is active in blue and galvanized sheets, tin plates, butt weld pipe, cold drawn and hot rolled steel products.

Non-Ferrous Metals—With the exception of zinc, the market in general is a trifle easier. Since Election Day, non-ferrous metal prices have reached new high records for the past twelve months. Zinc is up ½c. per lb. from the Jan. 16 level, in New York warehouses. The present upward trend in prices of fabricated brass and copper products, is a reflection of the recent advances in the raw metals.

(All prices as of Jan. 23)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	30.25
BIRMINGHAM	
No. 2 Foundry	20.00@20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70	3.89	3.45	3.80
No. 12	2.80	3.94	3.50	3.85
No. 14	2.90	3.99	3.55	3.95
No. 16	3.10	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.45	4.40	4.15	4.30
Nos. 22 and 24	3.50	4.45	4.20	4.35
Nos. 25 and 26	3.55	4.50	4.25	4.40
No. 28	3.60	4.60	4.35	4.50
Galvanized				
Nos. 10 and 11	3.75	4.60	...	4.50
Nos. 12 and 14	3.85	4.70	....	4.60
Nos. 16	4.00	....	....	....
Nos. 17 and 21	4.15	5.00	....	4.90
Nos. 22 and 24	4.30	5.15	3.00	5.05
No. 26	4.45	5.30	4.15	5.20
No. 28	4.75	5.60	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	56%	43%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (3.00@3.10 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; ⅛, 7¾c.; 5/32, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			58.25
Lead (up to carlots), St. Louis	10.00	New York	10.50
Zinc (up to carlots), St. Louis	7.60@7.65	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.25	21.00	16.25
Copper sheets, base	23.00	23.25	22.12½
Copper wire, base	20.62½	21.87½	20.75
Copper bars, base	22.25	23.75	22.62½
Copper tubing, base	25.25	25.87½	25.75
Brass sheets, base	19.62½	20.25	19.25
Brass tubing, base	24.25	26.00	25.00
Brass rods, base	17.62½	19.37½	18.37½
Brass wire, base	20.12½	21.25	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27 00
Zinc sheets (casks)	11.75	12.25	11.37
Solder (½ and ½), (case lots)	.42½@.43½	37.50	.....
Babbitt metal (83% tin)	60.00	68.50	50.00
Babbitt metal (35% tin)	28.00	21.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12 75@13.00	12.75	12.00
Copper, heavy, and wire	12.50@12.75	12 50	11.50@11.75
Copper, light, and bottoms	10.75@11.00	11.00	10.50
Heavy lead	8.00@ 8.25	8.00	8.00
Tea lead	7.00@ 7.25	6.50	6.75
Brass, heavy, yellow	7.75@ 8.00	8.00	8.00@8.25
Brass, heavy, red	9.75@10.00	10.00	9.75
Brass, light	6.50@ 6.75	7.00	6.75
No. 1 yellow rod turnings	8.25@ 8.50	8.00	8.00
Zinc	4.50@ 4.75	4.00	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@ .15½	.18	.09½@.12½
Wiping cloths, 13½x13½, per lb	12.00*	36.00 per M	.11
Wiping cloths, 13½x20½, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.18	1.33	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	60%
Second grade	50–10%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0405	.044
Brass rods	per lb	.1762½	.1637½	.15
Solder (½ and ½)	per lb.	42½@.43½	40@.41	.3475
Cotton waste	per lb.	.15@ 22	.14@.21	14@21
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3 38	3.38	3.38
Lard cutting oil	per gal.	.60	.55	.55
Machine oil	per gal.	.29	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	45%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	...	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.75@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@5.75
White lead, dry or in oil	100 lb. kegs	New York, 16.75	
Red lead, dry	100 lb. kegs	New York, 16.75	
Red lead, in oil	100 lb. kegs	New York, 18.25	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ½-in., ¾-in., 1x2-in. to 5-in., per 100 lb.	$3.75	$3.50	$3.50
Cone heads, ditto	3.85	3.60	3.70
Washers, cast iron: ½-in. per 100 lb.	6.50*	4.00	3.75
¾-in., per 100 lb.	5.50*	4.00	3.75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 35%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 40%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 35%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 45%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 45%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, $\frac{5}{16}$x1-in. and longer, 19c. per lb., less 60%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ½-in. dia., 35c.; ⅝-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ark., Magnolia — H. D. Hutcheson, H. Hutcheson, Pur. Agt.—sanding machine, for wood work. (used).

D. C., Washington—A. L. Flint, General Purchasing Officer, Panama Canal, will receive bids until February 4, for end mills, reamers, drills, dies, saws; band, rip, cutoff, circular, metal splitting, high-speed steel, etc. (Cir. 2372).

La., New Orleans—The Cahn Richards Tool Co., 711 Camp St.—portable turret lathe, 9-10 in. swing, with 6 point turret.

Mass., Atlantic—C. S. Garrity, River St. —(pattern makers) band saw and buzzer planer.

Mass., Auburn—The Baldwin Chain and Manufacturing Co., Wrocester—additional machinery, for new chain and sprocket manufacturing plant here.

Mass., Boston — Schoolhouse Dept. — manual training equipment, including metal and wood working machinery, for Charles Sumner School, West Roxbury.

Mass., Chelsea—J. Frieman, 104 Spruce St., miscellaneous tools and equipment for repair and service garage.

Mass., Chelsea—G. Shauffer, 32 Elm St.—equipment and tools for repair garage on Chester St.

Mass., Dorchester (Boston P. O.)—Barnet Lesser, 12 Brook Ave.—miscellaneous tools and equipment for repair and service garage.

Mass., South Boston (Boston, P. O.)—Simons Saw and Steel Co., 44 Farnsworth St.—machinery and equipment for plant addition.

Mass., South Boston (Boston P. O.)—Z. Strigun, 211-213 I St.—miscellaneous tools and equipment for repair and service garage.

Mich., Detroit—Detroit Woodcraft Corporation, Porter & Fourth Sts., woodworking machinery, including lathe.

Mich., Grand Rapids—Haynes Ionia Co., Seventh and Muskegon Aves., equipment for making steel stampings.

Mo., St. Louis — South End Sash and Door Co., 4216 Gravois Ave., saw chain mortiser. (New or used).

N. J., New Durham — **J. F. Maurer,** small, three drum sander.

N. Y., New York—Janssen Engineering Co., 233 Broadway—8 ft. squaring shears.

N. Y., New York—Motor Improvement Co., 257 West 57th St. — Taylor electric welder No. S-6-2, and metal stamping power press.

O., Bellefontaine—Gramm-Kincaid Motors, Inc.—(manufacturers of motor trucks) machinery and equipment for modern truck plant. Russell Kincaid, Purch. Agt.

O., Columbus — The Eureka Avenue Lumber Co., Eureka Ave., G. Hardesty, Mgr.—1 sander, 1 cutoff saw.

O., St. Clairsville—N. A. Neff Co., N. A. Neff, Mgr.—(lumber and mill work) equipment for woodworking mill, 1 combination machine, 2 molders, and 1 sander.

Va., Richmond—The James McGraw Co., Tenth and Cary Sts., 1 surface grinder, for grinding bases of pumps, bases 6 x 18 in. long, 9 in. high, 37 x 37 x 61 in. high.

Wis., Merrill—J. C. Webb., excelsior manufacturing plant, saws, and excelsior making machinery, including shredder, to replace fire loss.

Wis., Milwaukee — Bina Manufacturing Co., 37 Erie St., St. John Bina, Pres.—one, 16 in. lathe, 2 medium size milling machines.

Wis., Milwaukee—Department of Public Works, R. E. Stoelting, Comr.—three ton crane.

B. C., Vancouver — American Can Co., Ltd., 535 Railroad Ave.—can making machinery, for proposed new factory, estimated cost $200,000.

Ont., Collingwood—C. Collins—complete equipment for sawmills, electrically operated. Estimated cost $25,000.

Ont., Strathryo—Hy Lo Jacks, Ltd., J. A. Carruthers, Pres.—equipment for the manufacture of all kinds of jacks, including hydrostatic, auto, etc.

Opportunities for Future Business

Calif., Alhambra — Hadden Automatic Sprinkler Co., 930 Maple Ave., Los Angeles, is having plans prepared for the construction of a 1 story, factory building, on A St. Estimated cost $40,000. Private plans.

Calif., Los Angeles—W. M. Gottschalk, 319 North Avenue 21, manufacturer of fibre furniture, plans the construction of a factory here. Estimated cost $40,000. Private plans.

Calif., Sacramento—The Electric Lawn Mower Co., 3325 Jay St., c/o W. W. Campbell, plans the construction of shops and factory, for the manufacture of lawn mowers. Estimated cost $40,000.

Ill., East St. Louis—St. Louis Pressed Steel Co., 2701 McCasland Ave., awarded contract for the construction of a 1 story, 100 x 100 ft. steel plant at 27th St. and McCasland Ave.

Md., Sparrows Point — Bethlehem Steel Co., will build a 2 story, rod and wire mill, by day labor. Estmiated cost $300,000. Private plans.

Mass., Auburn—J. W. Bishop, Co., 125 Foster St., Worcester, will build two factories, one, 1 story, 160 x 475 ft., and a 2 story, 50 x 125 ft. on Webster Rd., for the Baldwin Chain & Manufacturing Co., manufacturers of power transmission chains and sprockets, lessee. Estimated cost $500,000.

Mass., Boston—J. D. Marr, c/o E. N. Adams, 86 Everett St., Arlington, Archt., will receive bids about February 1, for the construction of a 2 story 100x200 ft. garage, Old Colony Ave. and D St., South Boston. Estimated cost $175,000. Noted January 19.

Mass., Boston—J. Murray Howe, 10 State St., plans the construction of a 6 story, 27,000 sq.ft. advanced ramp type garage, on Bowdoin Sq., Green St. and Stanford Pl. Architect not selected.

Mass., Lynn—M. Levin, 204 Summer St., is having preliminary plans made for the construction of a one story repair shop and garage, on Blossom and Wheeler Sts. Estimated cost $40,000. G. Cornet, 10 Central Ave., Archt.

Mass., New Bedford—M. B. Davis, 155 Main St., Brockton, plans the construction of a 2 story, 100x145 ft. garage, at Spring St. and Acushnet Ave. Estimated cost $160,000. R. P. Jackson, 86 Main St., Brockton, Archt.

Mich., Grand Rapids—Hayes Ionia Co., Seventh and Muskegon Aves., awarded contract for the construction of a steel stamping plant. Estimated cost $40,000.

Mo., St. Louis — Compton Planing Mill Co., 3313 South Compton Ave., will build a 2 story, 32x80 ft. addition to planing mill, by day labor. S. O. Schumacher, 8635 Mera Lane, Archt.

N. J., Camden — R. M. Hollingshead, Cooper St., awarded contract for the construction of a factory for the manufacture of auto supplies, also an administration building.

N. C., Charlotte—H. C. C. Coddington, awarded contract for the construction of a 5 story 100x200 ft. automobile sales and service building, on Trade and North Sts Owner to purchase equipment. Noted Jan. 21.

N. C., Charlotte — Terrell Machine Co., have retained Lockwood Greene & Co., Engrs., to design and supervise an extension to its plant.

O., Cleveland—The Central Brass Manufacturing Co., c/o E. A. Eckhouse, Pres., East 55 St., awarded contract for the construction of a 3 story 63x122 ft. factory. Estimated cost $125,000. Noted Dec. 18.

O., Cleveland — MacDonald Manufacturing Co., M. MacDonald, Pres., 5015 Wellesley Ave., (press registers) awarded contract for the construction of a 1 story, 38 x 60 ft. factory addition. Estimated cost $40,000. Noted Jan. 22.

O., Cleveland—The May Co., Nathan L. Danbury, Vice Pres., Euclid and Prospect Aves., have completed plans for the construction of a 3 story, 150 x 198 ft. garage on West 2nd St. and Lakeside Ave. Estimated cost $259,000. Lehman Schmitt Co., Lernkin Conkey Bldg., Archts.

O., Cleveland — Mueller Electric Co., R. S. Mueller, Pres., 1583 East 31 St., (appliances) awarded contract for the construction of a 1 story, 38 x 60 ft. factory. Estimated cost $40,000.

O., Cleveland — Pioneer Machinery & Eng. Co., c/o W. Maerble, 1725 Merwin Ave., Secy. and Treas. plans the construction of a 1 story, factory, here. Estimated cost $40,000. Architect not selected.

O., Dayton—Air Friction Carbureter Co., Linden Ave., plans the construction of a 2 story, 60x180 ft. addition to factory. Estimated cost $75,000. Architect not selected.

O., Kent—Gouglar Machine Co., plans the construction of a machine shop, here. $50,000. Architect not announced.

O., North Olmstead—A. Robinson Co., A. H. Robinson, Pres., 5103 Detroit Ave., Cleveland, manufacturer of air furnaces, is having plans made for the construction of two, 1 story, 60x120 ft. and 60x60 ft. factory buildings. Estimated cost $60,000. Wm. Serene, 5103 Detroit Ave., Cleveland, is architect.

O., Piqua—The Meteor Motor Car Co., is having sketches made for the construction of a 2 story, 60 x 600 ft. auto factory, here. Estimated cost $150,000.

Wash., Bellingham — Bloedel Donovan Lumber Co., had plans prepared for the construction of a box factory, here. Estimated cost $500,000. J. McMahon, Supt. of Construction.

Wis., Milwaukee—Department of Public Works, R. E. Stoelting, Comr., having plans prepared for the construction of a 1 story, 129 x 462 ft. central repair plant, Estimated cost $150,000. C. E. Malig, City Hall, Archt.

Wis., Two Rivers—Kahlenberg Bros. Co., c/o W. Kahlenberg, Pres., will soon receive bids for the construction of a 1 story, 60x152 ft. addition to factory. Estimated cost $45,000. Noted January 19.

B. C., Vancouver — American Can Co., Ltd., 535 Railroad Ave., is having plans prepared for the construction of a 4 story, 160 x 260 ft. factory, on Railroad Ave. Private plans.

Ont., Collingwood—C. Collins is having plans prepared for the construction of sawmills, here. Estimated cost $25,000.

Ont., Niagara Falls—Burgess Battery Co., awarded contract for the construction of an addition, to its dry cell battery factory. Estimated cost $60,000.

Ont., Toronto—American Radiator Co., Dominion Bank Bldg., plans the construction of a 1 story, 135 x 300 ft. machine shop, to replace one destroyed by fire. Architect not selected.

Que., Thurso—Singer Manufacturing Co., St. Johns, plans the construction of a factory here. Estimated cost $1,000,000. Architect not selected.